THE ROLE OF SCARCITY AND ATTENTIONAL FOCUS IN GOAL CONFLICT

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Consumers constantly face a pull between competing goals in their everyday lives. The present research examines a novel factor proposed to influence relative goal activation during a self-control conflict—scarcity. In Chapter 1, I review relevant literature to build a theoretical case for the proposition that scarcity influences attention to goal-relevant cues in an unrelated self-control conflict.

Chapters 2-4 are comprised of the eleven studies that experimentally test the proposed paradigm. In Chapter 2 (comprised of Studies 1, 2A, 2B, and 2C) I demonstrate the effect of time scarcity on food choice, a proxy for the competing goals of weight control and eating enjoyment. I also identify the population subset for whom the effect occurs, those who struggle with weight regulation.

The focus of Chapter 3 is a deeper examination into the process through which scarcity influences the prioritization of a given goal under conflict: diverting attention to goal-relevant cues. Studies 3 and 6 assess attention directly using a concurrent written protocol and a dot probe task, respectively. Studies 4 and 5 provide moderating evidence as to how the effect can be extinguished. The studies in Chapter 4 (Studies 7-9) broaden the scope of the current paradigm to another domain of scarcity beyond time and another form of goal conflict, impulsive spending. Chapter 5 concludes with a discussion of open questions that stand to be addressed by future research.

BIOGRAPHICAL SKETCH

Prior to joining Cornell University, Catherine Wiggins worked as an analyst at NERA Economic Consulting and received her BA in economics and psychology from Wesleyan University. She began her doctoral studies in Cornell's Department of Human Nutrition before transferring to the Johnson School to pursue her PhD in Management. Catherine's research seeks to help consumers make healthier choices, and her interests span self-control and impulsive consumption, goals and motivation, and time and temporal perspective. Her passion for health promotion also extends outside of academia: during her doctoral program, she completed her training certification in barre and taught group fitness classes for Cornell students.

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TABLE OF CONTENTS

LIST OF FIGURES

CHAPTER 1

INTRODUCTION AND CONCEPTUAL BACKGROUND

INTRODUCTION

Consumers constantly face a pull between competing goals in their everyday lives. They wish to save for retirement *and* splurge on a new car; to prevent heart disease *and* satisfy a craving for rich and fattening foods. In such a self-control conflict, attention to goal-relevant cues will play an important role in determining the relative activation of competing goals. In turn, relative activation affects which goal will dominate in the ensuing goal pursuit. The present research examines a novel factor proposed to influence relative goal activation during a self-control conflict – scarcity.

In what follows, I first review existing research on multiple goal pursuit and goal conflict, especially within the domain of eating behavior that comprises the bulk of the reported studies. I then summarize relevant research on scarcity and its effect on attentional focus. Taken together, I build a theoretical case for the proposition that scarcity influences attention to goal-relevant cues in a self-control conflict that is unrelated to the scarcity domain.

Eleven studies then examine the role of scarcity in goal conflict. The first set of four studies (Studies 1, 2A, 2B, and 2C) demonstrate the effect of time scarcity on food choice, a proxy for the relative activation of the competing goals of weight control and eating enjoyment. Study 1 provides observational evidence that

perceptions of time scarcity are associated with more unhealthy items allocated to a virtual shopping basket. Causal evidence is then provided to demonstrate that scarcity produces greater preference for an unhealthy (but tasty) option compared to a more healthful alternative (Studies 2A-2C). Importantly, these studies demonstrate the population subset for whom the effect occurs, those unsuccessful in weight regulation.

A next set of studies (Studies 3-6) delves into the proposed process through which scarcity influences the prioritization of a given goal under conflict. Remaining within the domain of food choice, I demonstrate that scarcity shifts attentional focus towards cues signaling taste and eating enjoyment, and away from weight control. Study 3 uses the content of participants' deliberations pertaining to taste and weight control mid-choice as a proxy for attentional focus. Study 6 uses reaction time measures during a visual dot probe task to provide further evidence of attentional allocation towards indulgent vs. healthy foods. Indirect evidence via moderation is also collected – demonstrating how prioritization of an enjoyment goal under scarcity can be mitigated by directing attention to cues that signal the competing weight control goal (Studies 4 and 5).

A final set of studies seeks to extend the domain of the current paradigm, in regards to both its source and effect. Studies 7 and 8 extend the effect of scarcity to another form of goal conflict, namely impulsive spending (a proxy for the competing goals of spending money to obtain a desired good vs. exercising self-control in spending). The results mirror those obtained within the food choice domain among unsuccessful weight watchers. Time scarcity increases spending only for a select group of individuals – namely those low in spending self-control. Generalizing

beyond the effect of the scarcity of time, Study 9 manipulates the scarcity of product stock (i.e., stock outs) in an online shopping context. It successfully reproduces the previously observed effect of (time) scarcity on food choice.

This dissertation concludes with a discussion of open questions that stand to be addressed by future research. The pervasiveness of scarcity in today's modern world (DeVoe and Pfeffer, 2011; Perlow, 1999; Carroll, 2008), coupled with the self-control conflicts that consumers encounter daily, underscores the importance and potential impact of these findings for public health and consumer well-being.

CONCEPTUAL BACKGROUND

Managing Competing Goals

In their everyday lives, consumers may hold and pursue a multitude of different goals (Fishbach and Dhar, 2005; Dhar and Simonson, 1999; van Osselaer and Janiszewski, 2012; Kruglanski, 1996; Laran and Janiszewski, 2009; Luoro, Pieters, and Zeelenberg, 2007). At times, these goals may conflict: the goal of saving for retirement is likely to be at odds with the desire to consume memorable experiences such as a luxurious vacation; doing well academically may conflict with the objective of maintaining an active social life; and staying in shape may conflict with the desire to enjoy delicious but fattening foods. The specific category of goal conflict that is the subject of the present research is a self-control conflict. A relatively hedonic goal is typically pitted against one that is more utilitarian and confers relatively delayed rewards. In particular, the majority of the studies herein focus on goal conflict within

the domain of food choice, where the tension derives from the competing goals of eating enjoyment and weight control (e.g., Stroebe, 2008; Stroebe et al., 2008; Veling, Aarts, and Papies, 2011; Stroebe, van Koningsbruggen, Papies, and Aarts, 2013).

Relative Goal Activation

Goals can vary in cognitive accessibility, and can be primed outside conscious awareness (for a review, see Custers and Aarts, 2005). Goals regulate behavior by guiding the processing of goal-relevant information and funneling attention to increase the accessibility of related constructs (Aarts, 2012; Aarts and Elliot, 2012). Effective goal pursuit requires that a goal and its related constructs remain accessible until attainment (or, until the individual has disengaged from its pursuit). A key factor in goal attainment is therefore the heightened ability to detect goal-relevant stimuli in the environment (Förster et al., 2005). Such ability can be honed over repeated experiences as individuals develop associative cognitive links between goals and related concepts (Aarts and Dijksterhuis, 2003). For example, developing an "implementation intention" that one will perform under a specific situational context produces goal-consistent behaviors when relevant cues are encountered in the environment (Gollwitzer, 1999). With repeated exposures over time, the ability of environmental cues to elicit such behaviors becomes automatic (Shah and Kruglanski, 2003; Shah, 2005; Fishbach, Friedman, and Kruglanski, 2003; Bargh and Ferguson, 2000; Gollwitzer, 1999).

Once a goal has achieved a critical activation level and been deemed a priority, it may inhibit the activation level of any concurrent, competing goals (Kruglanski et

al., 2002). Further, this process may occur outside of consciousness through practice and habitualization (Shah, Friedman, and Kruglanski, 2002). For example, individuals holding egalitarian goals may "shield" this valued goal by inhibiting discriminatory generalizations when exposed to stereotyped groups (Moskowitz et al., 1999). Similarly, successful dieters may inhibit thoughts about a food's palatability upon exposure to unhealthy temptations (Danner et al., 2011). In the present research, I propose that a novel contributor – scarcity—funnels attention toward goal-related cues under a self-control conflict.

Scarcity and Attentional Focus

By scarcity, I refer to the subjective experience of "having less than you feel you need" (Mullainathan and Shafir, 2013). Specifically, it is 1) the perception that one's available resources are not sufficient to meet one's needs and 2) the corresponding subjective experience and evaluation that arises from this disparity. Prior research has established that scarcity creates a narrowing of attention focused at "managing the scarcity at hand" (Mullainathan and Shafir, 2013). For example Mani et al. (2013) demonstrate that poverty (a condition of financial scarcity) has a detrimental effect on cognitive tasks requiring working memory and logical thinking. The authors found that among New Jersey mall shoppers, considering a hypothetical financial decision (a car repair) impeded performance on unrelated spatial and reasoning tasks. However the effect only surfaced under scarcity, i.e., when resources to meet the repair were insufficient. Specifically, it occurred among low (but not high) income participants when the hypothetical repair was high (but not low) in cost. Similarly, Indian sugarcane farmers performed worse on similar tasks prior to a

harvest (a condition of scarcity) compared to after a harvest when resources were more bountiful.

While not pertaining to monetary resources per se, researchers have successfully manipulated conditions of scarcity vs. abundance (e.g., a high or low "budget" of time, guesses, or virtual slingshots at a target). Rather than looking at performance on cognitive tasks, Shah, Mullainathan, and Shafir (2012) examined how conditions of scarcity affect the tendency to borrow from the future. The authors distributed budgets across multiple rounds of a game in which unused budgets could be "saved" for later rounds. Budgets could also be "borrowed" from future rounds. Those with "poor" budgets (i.e., a more limited number of guesses or shots) borrowed more from the future than those with "rich" budgets. However this increased borrowing amongst the poor did not improve performance in current rounds, and only served to sacrifice performance in later rounds. The authors argue that scarcity produces an attentional neglect of the future to meet immediate needs, drawing similarities to modern "debt trap" scenarios (Edsall, 2013; Montezemolo, 2013).

Physical states of scarcity such as hunger (scarcity of food), and dehydration (lack of water) have been shown to produce a similar directing of attentional focus towards addressing the scarcity at hand. Loewenstein (1996) argues that "as visceral factors intensify, they focus attention and motivation on activities and forms of consumption that are associated with the visceral factor…Non associated forms of consumption lose their value". Direct measures of attention in hungry vs. sated participants support this notion. Radel and Clément-Guillotin (2012) found that compared to sated participants, hungry participants reported better visibility and

detection of food-related, but not neutral words. Mogg et al. (1998) demonstrated that hungry subjects showed a greater attentional bias for (i.e., were faster to identify the location of a probe that preceded) food-related words relative to neutral household items in a dot probe task. Piech et al. (2009) found that food (but not neutral) stimuli decreased subsequent target detection in hungry, relative to sated participants in an attentional blink task. Furthermore, this "attentional capture" persisted despite monetary incentives to perform well.

Attentional Focus on Non-Scarcity Targets

In the prior research cited, attentional focus has been directed at the source of scarcity, i.e., "managing the scarcity at hand" (Mullainathan and Shafir, 2013). The present research examines the possibility that scarcity effects on attention can carry over into an unrelated domain. In other words, scarcity may promote an attentional focus on scarcity-independent targets. While not examining attention per se, prior research has demonstrated the existence of "carry over" effects of scarcity. Mehta and Zhu (2015) found that a scarcity prime in one domain (growing up with abundant vs. limited resources) promoted more creative product usage in an unrelated task. I propose that an effect of scarcity can carry over to goal conflict by directing attention to goal-relevant cues. In a situation where two goals are competing, this consequently affects relative goal activation and subsequent action.

The present research examines this possibility largely within the domain of food choice, and the competing goals of weight control and eating enjoyment (Studies 7 and 8 expand the effect to the domain of impulsive spending). Goal conflict models

of eating (e.g., Stroebe, 2008; Stroebe et al., 2008; Veling, Aarts, and Papies, 2011; Stroebe et al., 2013) propose that dietary failures are driven primarily by the hedonic aspects of unhealthy temptations and the anticipated eating enjoyment that they prime. Even individuals who are highly motivated to control their weight may experience self-regulatory failures in certain environments. When environmental cues prime the competing goal of eating enjoyment (e.g., when the smell of freshly baked cookies wafts through the room), self-control failures may occur. This results from preferential processing of a food's hedonic properties, which prioritizes an eating enjoyment goal and suppresses one of weight control (Stroebe et al., 2013). Conversely, cues that support a weight control goal (e.g. posters of fit athletes on the wall), promote activation of a weight control goal at the expense of eating enjoyment. I propose that scarcity experienced in an unrelated domain can produce carry over effects to goal conflict. Specifically scarcity directs attention to environmental cues that signal either eating enjoyment or weight control.

Moderation by Individual Differences

But toward which goal and its associated cues will scarcity direct attention? Individuals who are chronically unsuccessful at weight control demonstrate an attentional bias towards tempting food stimuli (for a review, see Hendrikse et al., 2015). These findings span a breadth of population samples (e.g., obese vs. normal weight; restrained vs. unrestrained eaters; high vs. low trait impulsivity). They also utilize a variety of methods such as the dot probe task (Mogg et al., 1998; Seage and Lee, 2017; Kemps et al., 2014; Werthmann et al., 2011); attentional blink task (Neimeijer et al., 2013); fMRI (Yokum et al., 2011); food Stroop task (Nijs et al.,

2010; Phelan et al., 2011); eye tracking (Castellanos, 2009; Graham et al., 2011); and the speed at which health vs. taste attributes are processed via mouse tracking (Sullivan et al., 2015).

I propose that success in weight control (Meule et al., 2012; Fishbach et al., 2003) will moderate the direction of attentional focus produced by scarcity. For those with an attentional bias toward tempting food (i.e., those who struggle with weight control), attention will be directed to the "prominent" goal of eating enjoyment and its relevant cues. Conversely for individuals who are successful at watching their weight, scarcity is not predicted to facilitate attention to eating enjoyment cues and subsequently activate the associated goal. Fishbach, Friedman, and Kruglanski (2003) demonstrate that among chronically successful weight watchers, exposure to temptations promotes the *activation*, as opposed to the inhibition, of a valued weight control goal. The authors argue that this capacity for "counteractive self-control" is formed through the development of facilitative links over repeated successful instances of self-control. These individuals have formed associative links in memory between temptations and the (weight control) goal-consistent actions that they elicit. Since the prominent goal for these individuals is not eating enjoyment, scarcity should not facilitate attention towards these cues.

Scarcity of Time

The majority of studies will examine a scarcity of time (Study 9 extends these findings to scarcity of stock in an online shopping context). Time is selected as a primary focus because it is a ubiquitous constraint: only 47% of Americans feel that

they have enough time (Carroll, 2008). Even the relatively time affluent face daily examples of scarcity (e.g., being on an important deadline for work, or experiencing traffic delays en route to the airport to catch a flight). And as demonstrated in the present research, time scarcity can be activated by subtle cues and manipulations.

Perceptions of "time famine" in which one has too much to do and too little time (DeVoe and Pfeffer, 2011; Perlow, 1999) are associated with such negative consequences as sleep disruption and failure to seek medical care when sick (Vuckovic, 1999; Lehto, 1998). Feeling chronically starved for time is associated with headaches, elevated risk of hypertension, and depressive symptoms (Yan et al., 2003; Kivimäki et al., 1996; Roxburgh, 2004). It is also known that scarcity of time promotes unhealthy consumption. Researchers argue that time scarcity leads individuals to prioritize convenience over the relative time-expense of healthfulness, such as eating fast food and preparing fewer home cooked meals (Neumark-Sztainer et al., 2003; Bava et al., 2008; Darian and Cohen, 1995, Presser, 1999; Furst et al., 1996). In these findings, unhealthy consumption occurs because consumers cannot allocate the required temporal resources towards the means (e.g., food preparation, shopping for healthy groceries) for successful pursuit of a weight control goal. As a consequence, individuals shift towards compensatory time-saving strategies such as eating takeout meals or skipping meals altogether (Blake et al., 2009; Devine et al., 2006, 2009; Jabs and Devine, 2006).

However the pathway through which I propose scarcity promotes self-control failure is distinct in its focus on the relative activation of competing goals. Specifically, scarcity is proposed to affect relative goal activation by directing

attention to goal-relevant cues. In the target domain of food choice, scarcity affects the activation of an eating enjoyment goal relative to one of weight control by directing attention to cues signaling taste and enjoyment vs. those signaling health and weight control. Figure 1 provides a conceptual overview of the proposed relationship between scarcity and relative goal activation.

FIGURE 1: OVERVIEW OF THE EFFECT OF SCARCITY ON RELATIVE GOAL ACTIVATION

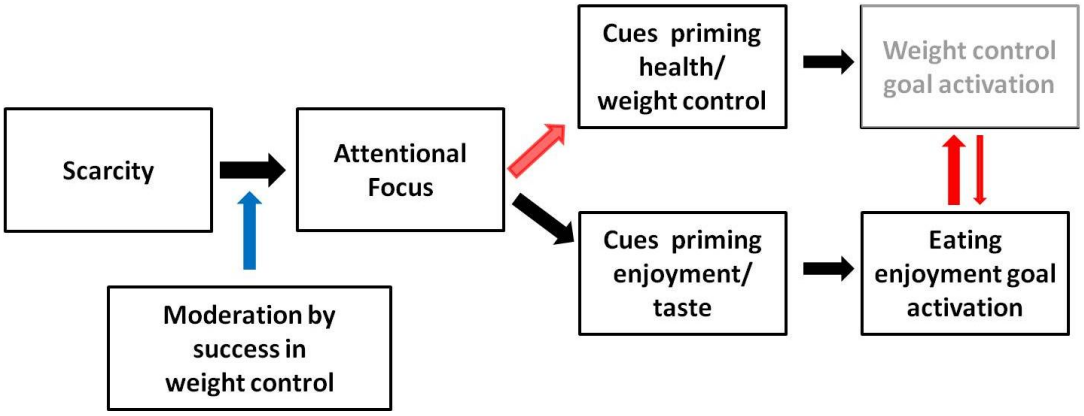

Figure 1: Overview of the effect of scarcity on relative goal activation. Among those unsuccessful in weight regulation, scarcity shifts attentional focus towards cues signaling taste and eating enjoyment, and away from those signaling weight control. This promotes the relative activation of the eating enjoyment goal and inhibition of the weight control goal.

A Note on Decision Making under Time Restraint

Before proceeding, it is important to distinguish the present work from related but distinct research examining the effects of decision-making under objective time constraints. Prior research has examined how reasoning and decision making are affected when participants complete tasks with limited vs. ample time, or when choice is solicited immediately vs. following a period of deliberation (e.g. Evans and Curtis-

Holmes, 2005; Gillard et al., 2009; Roberts and Newton, 2001; De Neys, 2006). Such work presumes that forcing participants to make quick decisions will yield inaccurate or biased responses as they rely more on intuitive and automatic (Type 1) processes rather than recruiting more deliberate, analytic, and accurate (Type 2) processes (for an exception, see Dijksterhuis, 2004).

The present work seeks to examine how scarcity influences consumers' attention to goal-relevant cues during a scenario that pits two goals against one another (an eating enjoyment goal vs. weight control; or the goal of spending money to acquire a good vs. exercising financial restraint). Important methodological differences from prior research should be noted. In the studies that follow, although a sense of scarcity is created prior to the dependent variable task, participants face no actual time constraint during this subsequent task. To allow verification that the scarcity manipulation does not cause participants to spend less time on the focal choice task, time-on task is discreetly measured in several studies.

Furthermore, time scarcity is proposed to promote unhealthy choice by directing attention to cues supporting a prominent goal (e.g., eating enjoyment for unsuccessful weight watchers). This underlying process is distinct from that operating under a time constraint in which an effect on the dependent variable is presumed to stem from a hasty decision or the absence of deliberation. In fact, a more "rushed" choice under the proposed theory might even promote healthier preference in a food choice setting, as it provides less opportunity to attend to thoughts of a temptation's palatability (for a similar argument regarding cognitive load, see Dillen et al., 2013). Further, in Study 3 process measures are gathered using a task that specifically

encourages contemplation by prompting participants to articulate their thought process. I propose that it is not an absence of sufficient deliberation that drives consumers towards unhealthy choices under scarcity. Rather, it is the content of this deliberation that matters—specifically whether one's attention is tuned more towards cues that support eating enjoyment or weight control.

THE PRESENT RESEARCH

Eleven studies examine the role of scarcity in goal conflict. The first set of four studies (Studies 1, 2A, 2B, and 2C) demonstrate the effect of time scarcity on food choice, a proxy for the competing goals of weight control and eating enjoyment. Importantly, Studies 2A-2C demonstrate the population subset for whom the effect occurs, those who struggle with weight regulation. I next examine the process through which scarcity influences the prioritization of a given goal under conflict in Studies 3-6. Using participants' direct self-reports (Study 3) and reaction time measures (Study 6), I demonstrate that scarcity shifts attentional focus towards cues signaling taste and eating enjoyment. I also demonstrate how prioritization of an enjoyment goal under scarcity can be mitigated by directing attention to cues that signal the competing weight control goal (Studies 4 and 5). Finally, Studies 7-9 broaden the scope of the current paradigm. In Studies 7 and 8 I extend the effect of time scarcity to another form of goal conflict, impulsive spending (a proxy for the competing goals to spend money vs. exercise self-control in spending). Study 9 generalizes away from time scarcity, instead manipulating product availability (i.e., stock scarcity) in an online shopping context. It reproduces the previously observed effect of time scarcity on food choice.

CHAPTER 2

DEMONSTRATING THE EFFECT AND FOR WHOM IT OCCURS (STUDIES 1-2C)

STUDY 1

Study 1 was conducted as a preliminary investigation of the relationship between scarcity and food choice. It examined whether greater perceptions of time scarcity are associated with less healthful choices. To this end feelings of time scarcity were measured prior to a hypothetical grocery shopping task. Greater perceptions of time scarcity were predicted to correlate with a higher incidence of unhealthy foods purchased. However, no such positive relationship was predicted for healthy items, whose purchase could have decreased or remain unchanged. To rule out concerns that those perceiving scarcity select unhealthy foods for their time-saving benefit, a pretest was conducted to ensure that the unhealthy and healthy items used in this study were balanced in this respect.

Method

90 Amazon Mechanical Turk workers (42% female; M_{age} = 34.5) completed the study online using Qualtrics. Participants' perception of time scarcity was assessed prior to their completing a simulated shopping task (modified from Thomas et al., 2012). In the simulated shopping task, participants viewed 24 food products, presented pictorially. Half of these products constituted healthy foods (e.g. Del Monte green beans), while the other half were unhealthy options (e.g. Red Baron Classic

Crust Pepperoni Pizza). Separate pretests drawn from a similar online sample confirmed that the unhealthy items were perceived as less healthy (M = 2.03) than the healthy items ("Please rate the healthiness of each food pictured" 1=very unhealthy 7=very healthy) M = 5.76; $t(24) = 12.43$; $p < .001$). The same pretest group verified no significant difference between the convenience ratings of the healthy and unhealthy items ($M_{\text{healthy}} = 5.88$, $M_{\text{unhealthy}} = 5.82$; $t(24) = 0.58$; $p > .50$).

In the main study, participants first completed a three-item index of perceived time scarcity adapted from Rudd, Vohs, and Aaker (2012). They rated their agreement on a scale of 1 (Strongly Disagree) to 7 (Strongly Agree) with the following three statements: "I have the sense that time is running out"; "Time is slipping away"; and "Time is constricted". These ratings were averaged to form an index of perceived time scarcity (alpha = .73). In addition, this study sought to distinguish an effect of subjective time scarcity from the distinct but related construct Future Time Perspective ("FTP"), or how much time one perceives to have left in the future (Carstensen, Isaacowitz, and Charles, 1999). Some researchers have reported a positive, albeit weak, correlation between a limited FTP and the tendency to discount future outcomes (for a review see Teuscher and Mitchell, 2011). I sought to preempt concerns that any observed relation between perceived time scarcity and unhealthy purchases was merely a reflection of FTP and, in turn, of participants' tendency to discount the future. Participants completed a subset of five items from Lang and Carstensen's (2002) Future Time Perspective Scale: "There are only limited possibilities in my future" (reverse coded); "Many opportunities await me in the future"; "My future seems infinite to me"; "There is plenty of time left in my life to make new plans"; and

"Most of my life still lies ahead of me" (alpha = .89). Participants then completed the simulated shopping task as part of, ostensibly, a separate and unrelated study. They viewed one food at a time and decided whether to add that item to their shopping basket. Items were presented in a random order, with no designed separation between the presentation of healthy and unhealthy foods.

Following the shopping simulation, participants reported their subjective importance of weight watching ("Watching my weight is important to me"; 1 = not at all; 7 = very much so; Fishbach et al, 2003) and their level of hunger (as recalled) at the beginning of the study (1= "Not hungry at all, I didn't even want to look at food"; 7 = "Completely famished, I could have eaten anything in sight"). Lastly, they provided demographic information, and were probed as to their thoughts on the study's intent. Unless stated otherwise, importance of weight watching, hunger, demographic information, and debrief questions were collected at the end of all food choice studies.

Results

Participants were excluded from analysis for two reasons. Three participants were omitted who reported an importance value of weight watching of 1 (not at all), because at least some degree of weight watching importance is a prerequisite for goal conflict between eating enjoyment and weight control. To preempt invalidity stemming from their states of hunger, seventeen additional participants were omitted who reported a hunger level of 1 ("*Not hungry at all (I didn't even want to look at food)"*). This practice is in line with eating behavior studies (e.g. Lawrence et al.,

2015) that require participants to refrain from eating for several hours beforehand to elicit a state of hunger. However, to avoid alerting participants to the study's focus on food choice, the assessment of hunger was delayed until the study's conclusion. Following exclusions, a final sample of 70 remained. For consistency, these exclusion criteria were applied to participants in all subsequent food choice studies unless otherwise noted. For all studies, including these participants does not change the directional pattern of the results, but as may be expected, does impact the size of the model coefficients and their significance values.

To control for variability in participants' hunger states, reported hunger rating was included as a covariate. In addition, because studies of food choice have reported significant effects of participant gender (e.g., Wardle et al., 2004), this variable was also included as a covariate. For consistency, these measures were included as covariates in all subsequent food choice studies unless the sample was limited to females. However, removing these covariates from the model does not affect the overall pattern of results for these studies.

Unhealthy purchases. All *p* values reported in this and subsequent studies reflect a two-sided test.

For each participant, the total numbers of healthy and unhealthy items added to the hypothetical shopping basket was computed. In addition, the proportion of unhealthy items to the total number of items in the basket was assessed. A regression of the total number of unhealthy items on perceived time scarcity rating revealed a significant effect of time scarcity (B = 0.986; SE = .295; p = .001), which remained

significant after controlling for the number of healthy items purchased (B = 0.987; SE = .297; p = .001). Substituting proportion for the number of unhealthy items in the basket as the dependent variable produced an analogous result (B = 0.056; SE = .021; p < .01). However, the total number of healthy items purchased did not yield a significant effect of time scarcity (B = 0.025; SE = .281; p > .90). Thus, time scarcity was associated with an increased incidence of unhealthy purchases, while exhibiting no correlation with participants' choice of healthy foods.

The relationship between time scarcity and number of unhealthy purchases was not merely a reflection of how expansive participants perceived their futures to be. FTP was significantly correlated with subjective time scarcity (r = -.52; p < .001). However when regressing the number of unhealthy purchases on FTP, the effect of this construct did not reach significance (B = -0.479; SE = .330; p =.15). Furthermore, when including both FTP and perceived time scarcity as predictors of unhealthy purchase, the significance of FTP was further reduced (B = 0.074; SE = .365; p > .80) while that of perceived time scarcity remained significant (B = 1.02; SE = .350; p = .005).

Discussion

Study 1 provides preliminary evidence that scarcity promotes unhealthy food choice. An alternative explanation—that time-starved individuals merely choose unhealthy items because they save time—was ruled out by the similar convenience ratings for healthy and unhealthy items. Further, the observed effect of time scarcity was not a reflection of how limited participants perceive their future to be (i.e., FTP).

STUDIES 2A, 2B, and 2C

Subsequent studies sought to establish a robust and causal link between feelings of time scarcity and unhealthy preference among the subpopulation of those unsuccessful at watching their weight. These individuals are generally more sensitive to cues signaling eating enjoyment (Stroebe et al., 2013). In the presence of a tempting food option, time scarcity should increase attention to cues supporting an eating enjoyment goal, at the expense of weight control. In turn, scarcity should promote the choice of the unhealthy option for these individuals.

Participants in Studies 2A-2C were randomly assigned to a time scarcity condition or a neutral control condition. They then completed a choice between a healthy and unhealthy snack which varied across studies. To verify the robustness and generalizability of this effect, two different manipulation of time scarcity was used across the studies.

Method

In Study 2A, 58 students (49 undergraduate, 9 graduate; 71% female; M_{age} = 21.1) completed the study in exchange for either $5 compensation or course credit. Participants were randomly assigned to a time scarcity condition or control condition in a between-subjects design. The study was described to participants as two unrelated surveys. The first was an anagram task that comprised the manipulation. Participants were presented with a series of English words and instructed to rearrange its letters to form a different English word. For example, when given the word "HORSE" and a clue denoting the first letter of the new word ("S____"), participants were to provide

the correct response “SHORE”. After five practice trials, participants completed three sets of five anagrams each. All participants were given the same amount of time—45 seconds—to complete each set before the page automatically advanced. Time scarcity was primed in its respective condition by (a) alerting participants to the 45-second time limit and by (b) displaying a timer on both the top and bottom of the page that ticked down from 45 seconds. In the control condition, the directions stated only that the page would automatically advance after “some time had passed,” and no timer was presented on the page. A separate sample of 40 participants drawn through Amazon Mechanical Turk confirmed that the manipulation successfully increased perceptions of time scarcity (“While completing the anagrams, I felt that I was running out of time”, “During the anagram task, I felt as though time was limited”; alpha = .85) ($M_{control} = 3.73$, $M_{scarce} = 5.03$; $t(39) = 2.33$; $p < .05$).

Because achievement goals are likely to be high among students (e.g., Gramzow, Johnson, and Willard 2014), a potential concern was that participants’ choices might be influenced by differences in perceived performance on the anagram task between the two conditions. For this reason the instructions in both conditions emphasized that most students would not solve all the anagrams in a set, and that they were not expected to do so. Rather, participants were encouraged to simply do their best.

Following the manipulation, participants were presented with a choice between two snack items: a Special K Blueberry Bliss granola bar (one individually wrapped granola bar), and a Mrs. Fields white chocolate macadamia cookie (one individually wrapped cookie). A pretest drawn from a separate online sample (N=30) confirmed

that the foods were matched in perceived convenience ("This food can be eaten on the go", "This food is a quick and easy snack", "This is a convenient snack for someone in a hurry"; $M_{SpecialK}$ = 6.24, $M_{Mrs.Fields}$ = 6.21; $t(29) = 0.13$; $p > .8$). However a separate pretest from an online sample (N = 24) confirmed that the two choices were distinct in their appropriateness for weight control ("This food is a good choice for someone watching their weight"; $M_{Mrs.Fields}$ = 1.96; $M_{SpecialK}$ = 4.88; $t(23) = 5.84$, $p < .001$). At the beginning of the study, participants were informed that they would make a choice between two products and that roughly half of them would be randomly selected to receive their choice. Participants were permitted to proceed only after acknowledging their understanding that the scenario constituted a real choice. After they viewed an image of each option on their screens, participants indicated their choice on a 7-point scale ("Which food do you choose to eat right now?"; "1="Definitely the Special K bar"; 7= "Definitely the Mrs. Fields cookie").

To preempt the possibility that participants in the time scarcity condition would simply make a rushed choice between snacks (Evans and Curtis-Holmes, 2005; De Neys, 2006), no time constraints were placed on the food choice task. More importantly, timing measures were discreetly collected to assess whether the participants in the two conditions differed in their length of deliberation. After indicating their choice, participants reported their perceived success in weight-watching using two measures adapted from Fishbach et al. (2003). Specifically, they indicated on 7-point scales (1= Not at all; 7 = Extremely) how successful they were in watching their weight and how difficult they found it to stay in shape (reverse coded) (alpha = .74). The original scale item "how successful are you in losing weight?" was

omitted in line with research demonstrating a distinction between weight loss and weight control (e.g., see Stroebe et al, 2013; Lowe, 1993, 1995). Specifically, not all individuals watching their weight may be trying to lose weight, but may merely be trying to avoid weight gain. To promote a global evaluation, instructions prompted participants to consider each question as it pertained to them generally, that is, not just at that moment.

At the conclusion of the study, roughly half of participants were randomly awarded their chosen snack and received a "snack code" to be submitted to the experimenter. They then collected their snack and their $5, if electing payment compensation. Remaining participants simply collected their compensation, as applicable.

Results

Eight participants were omitted from analysis based on the exclusion criteria stipulated previously, leaving a final sample of 50.

Unhealthy preference. Preference (a continuous variable) for the unhealthy snack (the Mrs. Fields cookie) was regressed on condition (coded 1 for time scarcity, 0 for control), weight-watching success (continuous), and their interaction. As in all other studies, hunger level (continuous) and gender (coded 1 for female, 0 for male) were included as covariates. While there was no main effect of condition, a significant interaction term surfaced between success and condition (B_{INT} = -1.24; $F(1, 44)$ = 4.63; $p < 0.05$). A floodlight analysis (Spiller et al., 2013) based on a fitted linear regression model was used to identify the range of weight-watching success for which

the time scarcity manipulation significantly increased unhealthy preference. Consistent with predictions, among those relatively low in weight-watching success, the manipulation shifted preferences towards the unhealthy snack option. Specifically, the analysis revealed a Johnson-Neyman point at levels of success of 3.00 and lower. That is, there was a significant effect of the manipulation in increasing preference for the unhealthy alternative for success levels less than or equal to 3.00 ($M_{control}$ = 2.10, M_{scarce} = 4.66; b_{JN} = 2.56; SE = 1.27; p = .05). This value corresponds to roughly 1.3 standard deviations below the mean of success in this sample ($M_{success}$ = 4.75; SD = 1.34). The effect of the manipulation did not reach significance for values of weight-watching success above this level. This result is summarized in the top panel of Figure 2.

FIGURE 2: EFFECT OF TIME SCARCITY ON PREFERENCE (STUDY 2A: TOP; STUDY 2B: MIDDLE; STUDY 2C: BOTTOM)

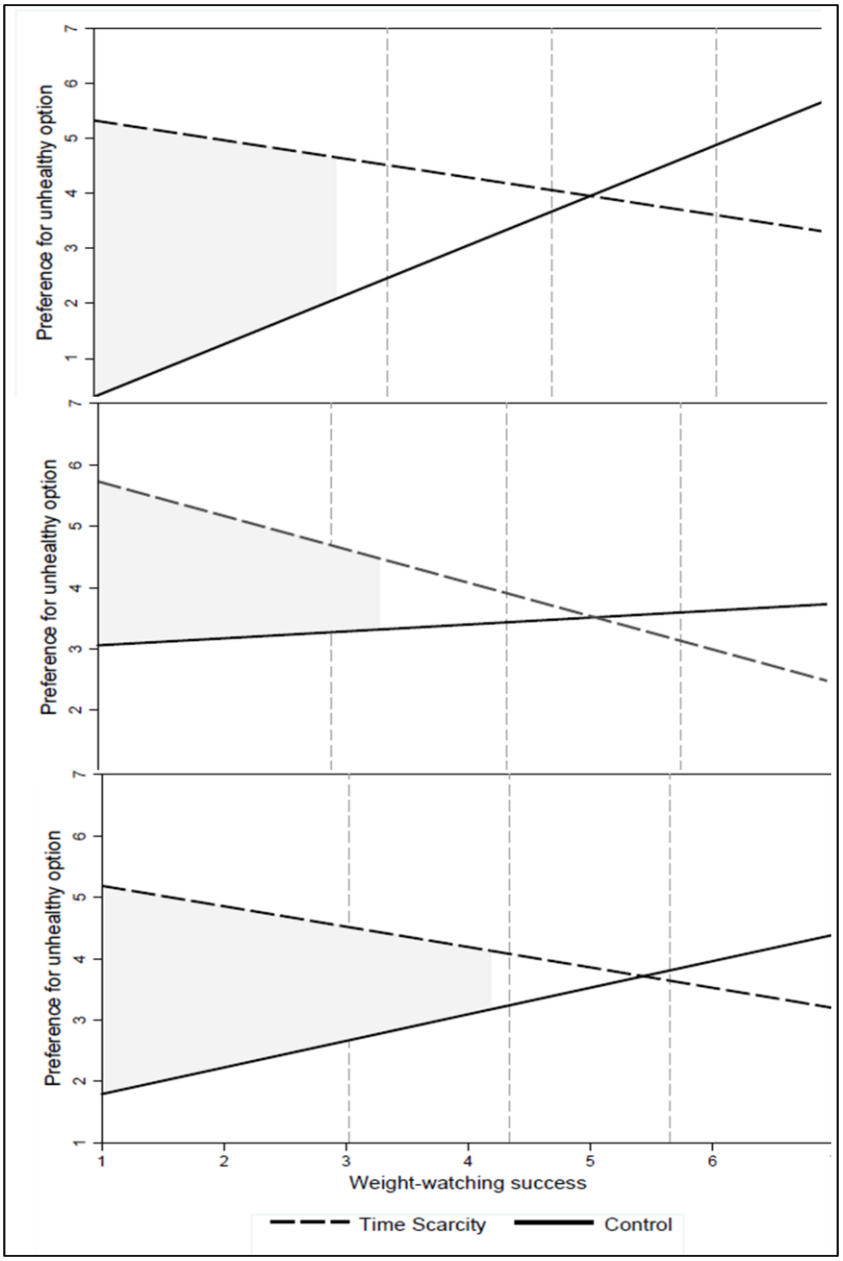

Figure 2: Studies 2a – 2c. Time scarcity increases unhealthy preference among unsuccessful weight watchers (Study 2A: top panel; Study 2B: middle panel; Study 2C: bottom panel). Shaded areas represent values of weight-watching success for which the time scarcity condition increases unhealthy preference relative to controls. Dotted vertical lines indicate the mean value of weight-watching success in each sample (center line) as well as 1 SD below (left line) and above (right line) the mean.

This difference in preference was not explained by participants rushing through their choice in the time scarcity condition. Time spent during choice did not differ between conditions, either as a main effect ($M_{control}$= 16.16, M_{scarce}= 17.06; $t(49) = 0.46$; $p > .60$) or qualified by an interaction with weight-watching success ($F_{conditionXsuccess}$ (1, 46) = 0.102; $p > 0.70$).

Study 2B sought to replicate these results using a more diverse U.S. sample drawn from Mechanical Turk. Study 2B also used a revised manipulation of time scarcity in order to rule out an alternative explanation based on an extraneous source of cognitive load. The time scarcity manipulation in Study 2A involved a timer that ticked down on the same page on which participants solved anagrams. This source of visual interference may have taxed participants' working memory capacity and driven subsequent unhealthy preference. Study 2B remedied this by separating the presentation of the timer in the time scarce condition from the anagrams themselves. It was visible only as participants began each set, but not while solving the anagrams. In addition, process evidence was collected to examine whether feelings of time scarcity were indeed driving the results, as opposed to feelings of frustration or incompetence associated with performance solving anagrams.

Method

150 participants (58% female; M_{age} = 35.8) were recruited from Amazon Mechanical Turk and completed the study online using Qualtrics. They were randomly assigned to either a time scarcity or control condition in a between-subjects design.

The manipulation of time scarcity again used an anagram task, but with several changes from Study 2A. As mentioned previously, in the time scarcity manipulation participants only saw the timer at the beginning of a set. When participants scrolled down to the first anagram, the timer disappeared from view. This permitted time scarcity to be primed without any visual interference while the anagrams were being solved. Additionally, the anagrams were also made easier (4-letter as opposed to 5-letter words), with the time limit reduced to 30 seconds to accommodate the easier words. Each set of five anagrams was pretested to take on average 30 seconds or less to complete. This was done so as to keep the number of anagrams completed in each condition relatively equal, and thus participants' perceptions of their ability to solve the anagrams roughly comparable. In turn, this should have minimized potential differences in feelings of frustration or incompetence between the two groups. Because on average even those in the time scarcity condition should have sufficient time to complete the task, *perceived* time scarcity could be manipulated while keeping the objective time available similar across conditions.

Following the manipulation, participants were presented with a hypothetical choice between two foods suitable for an afternoon snack—sliced apples with nut butter and a chocolate chip cookie. A pretest (N=26) confirmed distinct health perceptions of each alternative ($M_{\text{cookie}} = 1.85$; $M_{\text{apple}} = 5.88$; $t(25) = 10.80$; $p < .001$). To convey similar levels of convenience participants were informed that each food was readily prepared and "available to eat right now, if you choose". After viewing the picture of each item on their screens, participants indicated their choice on a 7-point

scale (“Which food do you choose to eat right now?” 1= “Definitely the apples and nut butter”; 7= “Definitely the chocolate chip cookie”).

Following the food choice, participants were instructed to recall their feelings of time scarcity from the earlier anagram task. Specifically, they rated their agreement with two statements (“While completing the anagrams, I felt that I was running out of time” and “During the anagram task, I felt as though time was limited”; alpha = .89). They were also asked to recall negative feelings stemming from the task, or resulting negative self perceptions (“The anagram task made me feel upset”; “The anagram task made me feel frustrated”; “The anagram task made me feel bad about my ability to solve all of the anagrams”; alpha = .86). These questions were presented in a random order and embedded within filler questions about the task (“I thought that solving the anagrams was fun”; “I found the anagram task to be difficult”; “Many of the anagrams were ones I had not seen before”).

Results

Seventeen participants were eliminated in line with the criteria stipulated previously, leaving a final sample of 133.

Unhealthy preference. As in the previous study, preference for the unhealthy option (the chocolate chip cookie) was regressed on condition (time scarcity vs. control), weight-watching success, and their interaction. Once again, there was no main effect of time scarcity, but a marginally significant interaction between weight-watching success and time scarcity condition surfaced (B_{INT}= -0.551; $F(1, 127) = 2.92$; $p = 0.09$). A floodlight analysis (Spiller et al., 2013) revealed a significant effect of the

manipulation in increasing preference for the unhealthy alternative for success levels less than or equal to 3.7 ($M_{control}$= 3.32, M_{scarce} = 4.31; b_{JN} = 0.996; SE = 0.502; p = .049). This corresponded to roughly 0.5 standard deviations below the mean of success in this sample ($M_{success}$ = 4.45; SD = 1.41). The effect of the manipulation did not reach significance for values of weight-watching success above this level. The middle panel of Figure 2 summarizes these results.

Mediation analysis. As intended, participants in the time scarcity condition reported greater feelings of running out of time during the anagram task ($M_{control}$ = 2.17, M_{scarce} = 5.13; t(132) = 10.64; p < .001). As an initial test for mediation by subjective feelings of time scarcity, to the model regressing choice on time-scarcity condition, weight-watching success (specified at the Johnson Neyman value), and their interaction, a term for feelings of time scarcity and its interaction with success (specified at the JN value) was added to the model. This reduced the effect of the condition to non-significance ($B_{original}$ = 0.996, $SE_{original}$ = .502, $p_{original}$ = .049; $B_{mediation\ model}$ = -0.217, $SE_{mediation\ model}$ = 0.746, $p_{mediation\ model}$ =.77) while the effect of perceived time scarcity on unhealthy preference remained significant (B_{scarce} = .389, SE = 0.178, p <.05). A further test of moderated mediation with 5,000 bootstrapped samples (Hayes, 2013) revealed that the pathway from condition to unhealthy choice through feelings of time scarcity (the indirect effect) was significant and did not include zero (indirect effect = 1.18; 95% CI: 0.050 to 2.30), which supports mediation.

Ruling out alternative explanations. The above results cannot be explained by feelings of frustration or incompetence, or by differences in deliberation time during the choice task. Recalled feelings of task-induced negativity were relatively low and,

importantly, did not differ significantly between conditions ($M_{control}$= 1.70, M_{scarce}= 1.88; $t(132) = 0.83$; $p > .40$). In a separate sample drawn from a similar online population (N=40) the effect of the manipulation on participants' levels of stress was also assessed ("The anagram task made me feel stressed"). The effect of the manipulation on stress did not differ by condition ($M_{\text{control}} = 2.30$, $M_{\text{scarce}} = 2.43$; $t(39) = 0.23$; $p > .80$) whereas feelings of time scarcity were significantly elevated by the manipulation ("While completing the anagrams, I felt that I was running out of time": $M_{\text{control}} = 2.80$, $M_{\text{scarce}} = 4.43$; $t(39) = 2.47$; $p < 0.05$).

There was no reliable difference between conditions regarding the time spent on the choice task. If anything, those in the time scarcity condition took longer to make their decision, though this directional effect did not reach significance (M_{control}= 27.23, $M_{\text{scarce}} = 34.05$; $t(132) = 1.43$; $p = .16$).

Taken together, Studies 2A and 2B replicate the effect of time scarcity on unhealthy preference while ruling out potential alternative explanations from general distraction, negative affect and stress, and hasty decision making. However in both Studies 2A and 2B participants in the time scarcity condition were made aware of the (supposed) time restraints they faced. This awareness may have altered their approach to the anagram task relative to those in the control condition. For example, participants who felt that time was limited may have exerted more effort during the anagram task in an attempt to ensure completion. This greater exertion, rather than feelings of time scarcity per se, may have contributed to preference for unhealthy foods. Study 2C was designed to rule out this alternative explanation by using semantic priming as an implicit approach to activate feelings of time scarcity.

Method

136 participants (37% female; M_{age} = 33.4) were recruited from Amazon Mechanical Turk and completed the study online using Qualtrics. Participants were randomly assigned to a time scarcity or control condition in a between-subjects design.

Participants completed a sentence-unscrambling task (Srull and Wyer, 1979) adapted from Rudd et al. (2012). They viewed 17 sets of 4 words each and selected 3 of these words to form a meaningful sentence or phrase. For those in the control condition, the word sets all related to neutral non time-related concepts (e.g., "the package mail letter"). However in the time scarcity condition, words in 11 of the sets pertained to constricted time (e.g., "minutes race by cars") .

All participants were presented with a hypothetical scenario in which they made a choice between a healthy alternative (fruit salad) and an unhealthy one (raspberry cheesecake). A pretest (N=26) confirmed distinct health perceptions of each alternative ($M_{cheesecake}$ = 1.65; $M_{fruitsalad}$ = 6.39; $t(25) = 13.92$; $p < .001$). As in Study 2B, each snack was described as readily prepared and available to eat right away. The dependent variable, choice, was assessed using a 7-point scale: "Which food do you choose to right now?" (1="I definitely want the fruit salad"; 7= "I definitely want the cheesecake").

Results

In keeping with the criteria stipulated previously, fifteen participants were excluded from the analysis, and one additional participant who did not complete all questions was eliminated. This left a final sample of 120.

Unhealthy preference. Preference for the unhealthy option (the raspberry cheesecake) was regressed on condition (time scarcity vs. control), weight-watching success, and their interaction. As before, there was no main effect of time scarcity but a significant interaction between weight-watching success and time scarcity condition (B_{INT}= -0.77; $F(1, 114) = 4.62$; $p < 0.05$). A floodlight analysis (Spiller et al., 2013) once again identified the range of weight-watching success for which the time scarcity manipulation significantly increased unhealthy preference. Consistent with predictions and Studies 2A and 2B, the scarcity manipulation shifted preferences towards the unhealthy option for success levels less than or equal to 4.2 ($M_{control}$ = 3.18, M_{scarce} = 4.12; b_{JN} = 0.94; SE = .45; $p < .05$). This value corresponded to roughly 0.1 standard deviations below the mean of success in this sample ($M_{success}$ = 4.34; SD = 1.31). The effect of the manipulation did not reach significance for values of weight-watching success above this level. These results are summarized in the bottom panel of Figure 2.

Again, time spent during choice did not differ between conditions ($M_{control}$ = 12.54, M_{scarce} = 13.18; $t(119) = .31$; $p > .7$). As in Studies 2A and 2B, this discredited the alternative explanation that the higher preference for the unhealthy option under time scarcity merely reflected a more rushed or hasty choice.

Discussion

The results of Studies 2A-2C support a causal role of time scarcity in promoting preference for tempting but unhealthy foods. The robustness of this effect is demonstrated by using different manipulations to prime this construct. The data also

ruled out alternative explanations related to general distraction, feelings of frustration or incompetence, and effort. Both a student sample and a more diverse online population demonstrate that under scarcity, those who are unsuccessful at watching their weight exhibit a higher preference for unhealthy temptations. Importantly, the shift in preference towards unhealthy foods cannot be explained by compensatory time-saving strategies, as the choice items were matched in their availability for immediate consumption (Studies 2B and 2C) and their ability to be eaten quickly on the go (Study 2A). In addition, these effects cannot be attributed to participants simply speeding through the food choice task: in all studies, the time spent on deliberation did not differ across conditions. Having achieved a robust demonstration of the effect and the specific sub-population vulnerable to it, the next set of studies delves into the underlying process.

CHAPTER 3

EXAMINING THE UNDERLYING PROCESS (STUDIES 3-6)

Studies 3-6 explore the underlying process through which scarcity increases preference for an unhealthy alternative. It is theorized that perceptions of time scarcity promote unhealthy choice among unsuccessful weight-watchers by shifting attention to cues signaling taste and enjoyment, thus prioritizing an eating enjoyment goal over one of weight control. The figure below provides an overview of this process examination and the contribution of each subsequent study.

FIGURE 3: PROCESS OVERVIEW OF THE EFFECT OF SCARCITY ON RELATIVE GOAL ACTIVATION

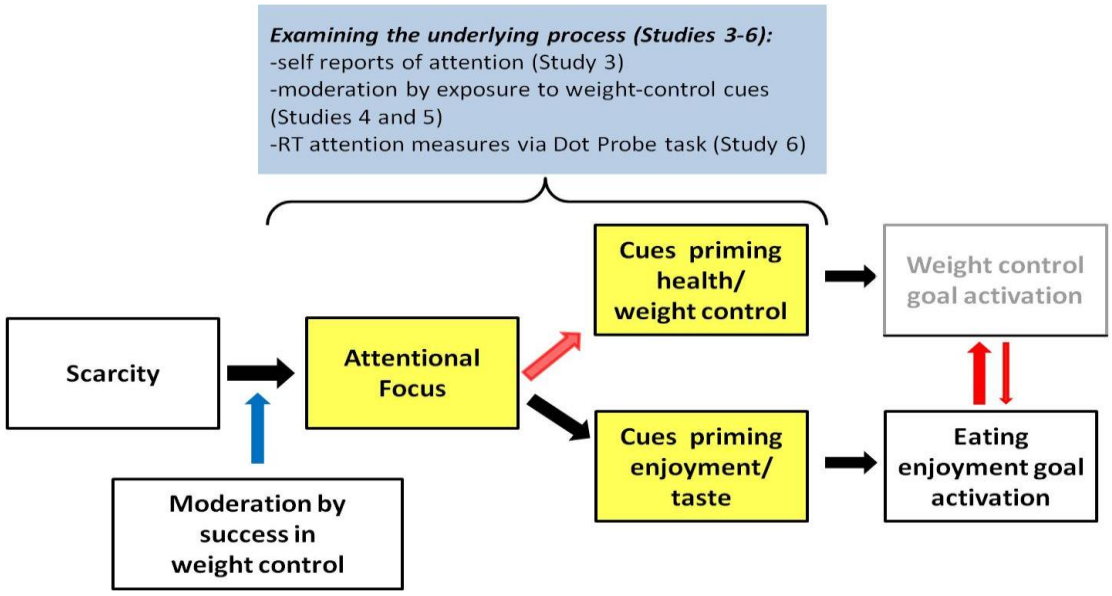

Figure 3: Studies 3-6. Examining the process through which scarcity affects relative goal activation. Among unsuccessful weight-watchers, scarcity shifts attention to cues signaling taste and eating enjoyment. Studies 3 and 6 measure attention via direct report and response time, respectively. Studies 4 and 5 demonstrate moderation of the effect following exposure to weight control cues.

STUDY 3

Study 3 used a modified concurrent verbal protocol to solicit participants' thought process in the middle of a choice task, when goals related to that choice process should be most active (Carlson, et al., 2014). The importance weights that participants ascribed to health/guilt and taste/enjoyment concerns at a specific point during their choice were used as a proxy for the relative attention given to cues supporting a weight control goal vs. an eating enjoyment goal, respectively.

If scarcity promotes the prioritization of an eating enjoyment goal (and subsequently unhealthy choice) among unsuccessful weight watchers by directing attention to cues that signal taste and enjoyment, the effect should only occur with a food that elicits such cues. Prior research has identified the palatability of a food as a crucial factor determining whether its exposure will initiate a "go" signal favoring consumption (Woody et al., 1981; Herman, Roth, and Polivy, 2003). A scarcity effect should not surface if the unhealthy option is not perceived as appealing.

To allow for this possibility, the unhealthy option in Study 3, a bag of Famous Amos cookies, was selected so as to be on average moderately appealing, but not overwhelmingly so. A pretest (N=25) assessed the appeal of this food by averaging participant responses to the following two questions on a 1-to-7 scale: "This food is very appealing" and "This food looks delicious" (alpha = .91). Pretest results confirmed an appeal rating that was moderate M = 4.14 (SD =1.83), yet lower on average than the unhealthy option used in prior studies as assessed in the same pretest: Study 2A ($M_{\text{Mrs.Fields}}$ = 5.14; SD = 1.46); Study 2B (M_{cookie} = 6.34; SD = 0.77); Study

2C ($M_{cheesecake}$ = 6.06; SD = 0.87). Scarcity should only direct attention to eating enjoyment cues when the unhealthy snack is perceived by participants as highly appealing.

Method

111 undergraduate students (55% female; M_{age} = 22.7) participated in this study for a choice between $5 cash compensation or course credit. Participants were randomly assigned to a time scarcity or neutral condition in a between-subjects design. The current study was run in conjunction with an unrelated survey on college student experiences. Participants first completed a series of demographic variables, embedded in which were questions about their success in weight-watching. Participants then completed the unrelated study before completing the manipulation of time scarcity (identical to Study 2C) and dependent variable measure.

In studies 2A-2C, the moderator, success in weight-watching, was assessed at the end of the study to avoid contaminating the dependent measure of food choice. In all three studies, follow-up analyses confirmed that there was no difference between conditions with respect to this variable (all *p*s > .50). Nonetheless, while participants were prompted to provide a response that characterized them generally, it is still possible that their earlier choice between the healthy and unhealthy snack may have influenced their perceived success, (e.g., "I choose the cookie, so I must not be that successful at watching my weight" (Bem, 1967). To ameliorate this concern, the success measure in Study 3 was collected prior to the manipulation and choice task. However, the intervening student experience survey allowed for a separation of the

success measure from the food choice task, thus minimizing any potential influence in the opposite direction.

In the food choice task, participants were presented with a choice between two snack items, a Kashi Honey Almond Flax granola bar (one individually wrapped granola bar) and a packet of Famous Amos chocolate chip cookies (one individual sized packet). They were pretested in two separate online samples be distinct in their appropriateness for weight control (N=24; $M_{\text{FamousAmos}} = 1.50$; $M_{\text{Kashi}} = 4.75$; $t(23) = 9.09$, $p < .001$) but similar in perceived convenience (N=30; $M_{\text{Kashi}} = 6.33$, $M_{\text{FamousAmos}} = 6.03$; $t(29) = 1.11$, $p = .3$). At the beginning of the study, all participants were informed that they would complete a choice scenario between two products and that they would receive their actual choice. They began the study only after acknowledging that the scenario constituted a real choice. Participants viewed images of each alternative and were asked to take a moment to contemplate their decision.

After the presentation of the two options and before they announced their preference, participants performed a modified concurrent verbal protocol. They were asked to write down an uncensored and unedited report of all thoughts while they considered the two food options. Specifically, they received the following instructions:

> *We'd like to understand what thoughts are running through your head at this very moment.*
>
> ***Please write whatever comes to mind*** *as you look at these two items and attempt to choose between them. Write freely and without any attempt to edit your thoughts or your writing (including spelling or grammar). Don't try to justify or explain your reasons, or worry about whether what you're writing "makes sense".* ***Just express whatever thoughts enter your mind, in whatever order they come****.*

Participants typed their thoughts into a text box, while both choice options were pictured on the screen. Following the concurrent written protocol, participants indicated their choice between the two items "Which food do you choose?" (1="Definitely the Kashi bar"; 7= "Definitely the Famous Amos cookie"). On the next screen, each participant was presented with the text from their written protocol, piped in from their earlier response. Using their own responses as a guide, participants were asked to report "How important were the following considerations when you were making your decision, **as reflected in the words you wrote** to describe what you were thinking at the time?"

Using a 100 point slider marked with the endpoints "Not at all important" (value = 0) and "Extremely important" (value = 100), participants indicated the importance of seven considerations. Two of these considerations pertained to concerns about weight control ("How healthy (or unhealthy) the food is" and "How guilty I would feel after eating this food"). Two considerations pertained to eating enjoyment ("How good the food would taste" and "How much I would enjoy the food"). The three remaining considerations served as fillers to mask the study's intent ("How suited the food is for the time of day"; "How filling each food is"; and "How much each food would cost if I had to pay for it"). A factor analysis was conducted using Stata 14 to verify that none of the three filler items loaded onto the weight control or eating enjoyment variables, and that they indeed captured distinct constructs. The use of self-coding to generate participants' importance weightings was intended to reduce the subjectivity inherent in independent coder ratings.

After a series of filler questions pertaining to the unrelated student experiences study, the extent to which participants found each alternative appealing was assessed ("This food is very appealing"; 1 = Completely disagree, 7 = Completely agree). At the conclusion of the study, participants submitted a "snack ticket" containing their unique (but anonymous) ID, placing it in one of two piles corresponding to the choice alternative and collected their snack along with their compensation, as applicable. Importantly, participants collected their snack in a separate room from the experimenter, to prevent any demand effects.

Results

Following the exclusion criteria stated previously, sixteen participants were eliminated leaving a final sample of 95.

Preliminary analysis: relative attention to weight control vs. eating enjoyment cues. Two indices were formed to represent the attention given to weight control considerations (average of the health and guilt items; alpha = .76) versus eating enjoyment (average of the taste and enjoyment items; alpha = .77). To promote comparability between the two indices, each item was standardized to units of one standard deviation from the mean. A relative attention score was created by subtracting the weight control index from the eating enjoyment index. A positive score indicated that greater attention was given to eating enjoyment cues relative to weight control cues, while negative values indicate greater attention to weight control over eating enjoyment.

Unhealthy choice. In the analysis that follows, participants final snack choice at the end of study (i.e., the snack selected and left with) was used rather than the continuous measure indicated on their computer. Replacing this continuous choice measure as the DV produced an analogous result to what is reported below.

Participants' snack choice (categorical) was regressed on condition (time scarcity vs. control), weight-watching success, temptation appeal and all interactions. This revealed a significant three-way interaction ($F(1, 85) = 8.58$, $p < 0.01$). This interaction was unpacked to examine the interaction between weight-watching success and time scarcity at various levels of temptation appeal. An effect of time scarcity among unsuccessful weight watchers (a replication of Studies 2A – 2C) was observed *only* when the unhealthy target was perceived to be tempting. Specifically, a spotlight analysis at 1 SD above the mean value of cookie appeal ($M_{\text{cookie appeal}} = 4.12$, SD = 1.61) revealed the familiar two-way interaction between success and time scarcity condition ($B_{\text{INT}} = -0.327$; $F(1, 85) = 4.97$; $p < 0.05$) . However the previously observed pattern failed to emerge at mean ($B_{\text{INT}} = -0.051$; $p > 0.6$) levels of reported snack appeal or lower.

When the unhealthy snack was viewed as highly appealing (spotlight at 1 SD above the mean of cookie appeal) the manipulation shifted preferences towards the unhealthy cookie snack among unsuccessful weight watchers. A floodlight analysis revealed a significant effect of the manipulation for success levels less than or equal to 3.5 ($M_{\text{control}} = .342$, $M_{\text{scarce}} = .833$; $b_{\text{JN}} = .491$; SE = .243; $p < .05$). This Johnson Neyman value corresponded to roughly 0.9 standard deviations below the mean of success in this sample ($M_{\text{success}} = 4.63$; SD = 1.24). The manipulation did not increase

unhealthy choice for values of weight-watching success above this level. This result is summarized in the right panel of Figure 4.

FIGURE 4: EFFECT OF SCARCITY ON RELATIVE ATTENTION SCORE AND UNHEALTHY CHOICE

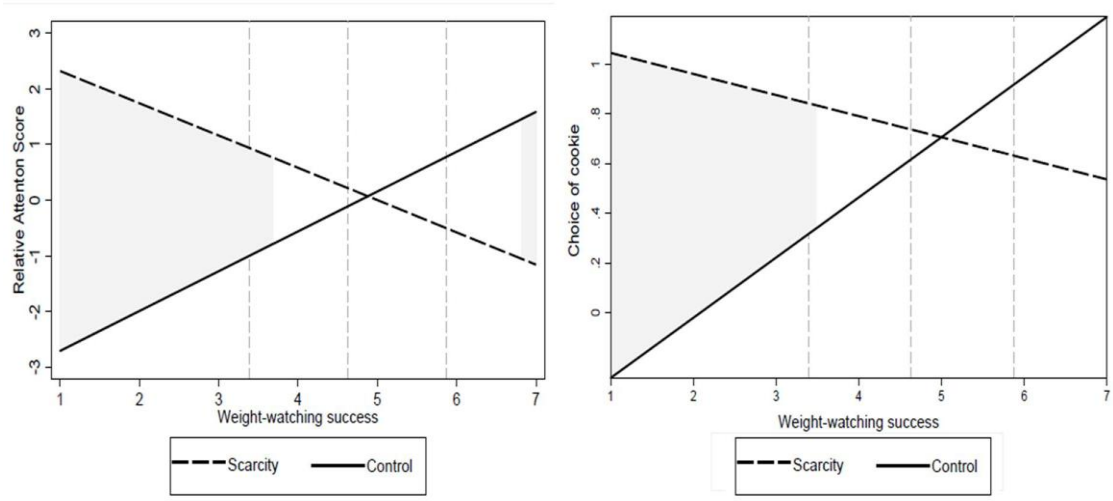

Figure 4. Study 3: Scarcity promotes greater attention to eating enjoyment vs. weight control (left panel) and unhealthy choice (right panel) among unsuccessful weight watchers. Results specified at a spotlight of high (1 SD above the mean) cookie appeal. Left Panel: Positive values indicate greater attention to eating enjoyment considerations relative to weight control. Shaded areas represent values of success for which the dependent variable significantly differs between conditions. Dotted vertical lines indicate the mean value of success in this sample (center line) as well as 1 SD below (left line) and above (right line) the mean.

Relative attention score. An identical analysis was carried out replacing choice with participants' relative attention score (eating enjoyment considerations vs. weight control) as the dependent variable. Mirroring the previous analysis for snack choice was a significant three-way interaction ($F(1, 85) = 9.61$; $p < 0.01$) between scarcity condition, success, and temptation appeal. Replicating the pattern observed for choice, a significant interaction between success and condition was observed *only* when the unhealthy option was viewed as highly appealing. A spotlight analysis at 1 SD above

the mean of cookie appeal revealed a significant two-way interaction between success and time scarcity condition (B_{INT} = -1.29; $F(1, 85) = 6.92$; $p = 0.01$) . However this interaction pattern failed to emerge at moderate (mean centered: B_{INT} = -0.311; $p > 0.3$) levels of cookie appeal or lower.

When the unhealthy snack was viewed as appealing (spotlight at 1 SD above the mean of cookie appeal) the manipulation shifted attention to taste and enjoyment considerations (at the expense of weight control) among unsuccessful weight watchers. Floodlight analysis revealed a significant effect of the manipulation for success levels less than or equal to 3.7 (roughly .75 SD below the mean) ($M_{control}$ = -0.772, M_{scarce} = 0.755; b_{JN} = 1.53; SE = .756; $p < .05$). These effects are summarized in the left panel of Figure 4 above.

Follow-up analysis. A follow-up analysis was conducted to examine whether the shift in relative attention score was driven by an increase in attention to eating enjoyment considerations, a decrease in attention to weight control considerations, or some combination of both. The previous analysis was repeated with the standardized form of each index serving as the dependent variable. Analyses revealed that the effect was driven by an increase in attention to eating enjoyment considerations. A significant interaction only emerged between scarcity and success for eating enjoyment (eating enjoyment: B_{INT}= - .956; $F(1, 85) = 8.18$; $p < 0.01$; weight control: $p_{INT} > 0.30$). At the previously determined Johnson Neyman value of 3.7, only the difference in eating enjoyment attention index was significant (eating enjoyment: b_{JN} = 1.00, SE = .514, $p = .05$; weight control: $p > .30$).

Mediation of snack choice by attention score. I examined whether unsuccessful weight watchers' greater preference for the unhealthy option under time scarcity was explained by an increase in the relative prioritization of eating enjoyment considerations over weight control. A test of moderated mediation was carried out using 5,000 bootstrapped samples (Hayes, 2013) with weight-watching success specified at the JN value for snack choice (3.5) and temptation appeal specified at 1 SD above the mean. The analysis revealed that the pathway from condition to unhealthy choice through relative attention score (the indirect effect) was significant and did not include zero (indirect effect = 0.356; 95% CI: .054 to .657), which supports mediation. The pathway and corresponding coefficients for the mediation model are show in Figure 5.

FIGURE 5: MEDIATION MODEL FOR TIME SCARCITY, RELATIVE ATTENTION SCORE, AND UNHEALTHY CHOICE

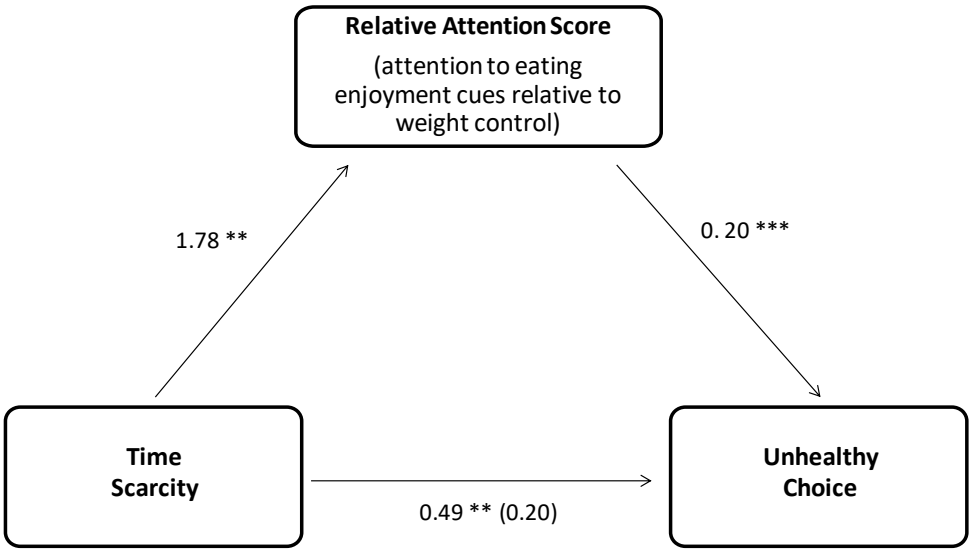

Figure 5. Study 3: Relative attention score mediates the effect of time scarcity on unhealthy choice among unsuccessful weight watchers. Regression coefficients for the relationship between time scarcity and unhealthy choice as mediated by relative attention score. The coefficient between time scarcity and choice, controlling for attention score, is shown in parentheses. Results specified at the JN point for weight-watching success (3.5) and at high (1 SD above the mean) values of temptation (cookie) appeal.
** Denotes $p < .05$ *** Denotes $p < .001$

There was no difference between the time scarcity and control conditions with respect to weight-watching success or temptation appeal (all *p*s > .20), nor was there a correlation between appeal ratings and weight-watching success (r = -0.003, p > .90). This alleviated concerns that the appeal rating might have reflected a general attitude towards temptations. Instead and as intended, this rating appeared to capture the perceived desirability of, and strength of the enjoyment cues elicited by, this specific cookie alternative.

A follow-up analysis sought to confirm that the appeal of the *tempting* (i.e., unhealthy) option specifically moderated the effect of scarcity. Replacing the term for temptation appeal in the model with the perceived appeal of the healthy option failed to reproduce the previously seen interaction pattern with condition and success ($p_{INT} > .6$). Further, controlling for appeal of the healthy option by adding this term to the model as a covariate did not change the significance or pattern of any result reported here. In addition, none of the other choice considerations (e.g. financial cost) that were included as fillers to mask the study focus displayed a main nor interacting effect of the independent variables (all *p*s NS).

Lastly, the time spent on the snack choice task did not differ between conditions ($M_{control} = 15.73$, $M_{scarce} = 15.78$; $t(94) = .04$; $p > .9$), nor did the length of participants' written responses (number of words) during the concurrent written protocol ($M_{control} = 46.22$, $M_{scarce} = 47.35$; $t(94) = 0.18$; $p > .8$). As in previous studies, this discredits the alternative explanation that scarcity led participants to rush through their decision process.

Discussion

The results of Study 3 provide process evidence as to *why* feelings of time scarcity increase preference for unhealthy foods: they increase the attention allocated to eating enjoyment concerns relative to weight control. Consistent with Studies 2A-2C, a scarcity effect emerged among unsuccessful weight watchers, however only when the unhealthy alternative was perceived as highly appealing. This last result simultaneously tests the robustness of the proposed theoretical mechanism and reveals

a meaningful boundary to the effect within the domain of food choice. The unhealthy option must be a true temptation, sufficient to allocate attention toward taste and enjoyment cues. Not just any packaged junk food will do.

Studies 4 and 5 seek to provide additional evidence as to what is driving the effect by manipulating the underlying process to reveal how it can be extinguished. Because scarcity is proposed to promote unhealthy preference by drawing attention to cues supporting an eating enjoyment goal, exposing vulnerable individuals to environmental cues that prime the competing weight control goal should offset its effect. In Study 4, these cues took the form of an ad conveying health-related (a fitness app) vs. neutral (a vacuum cleaner) content. In Study 5, this cue was delivered through the presence vs. absence of calorie information. In the absence of any cue directing attention towards weight control, a replication of Studies 2A-2C was predicted among unsuccessful weight watchers (greater preference for the unhealthy snack). However, the effect of scarcity should be mitigated for those exposed to a weight control cue.

STUDY 4

As part of an ostensibly separate study, participants were first exposed to either a fitness advertisement or to one of neutral content. The fitness ad was expected to shift attention toward weight control. Similar manipulations have proven successful in the activation of related goal constructs (e.g. Papies and Hamstra, 2010; Papies and Veling, 2013).

Method

200 participants were recruited from Amazon Mechanical Turk (53% female; M_{age} = 35.3) and completed the study online using Qualtrics. Participants were randomly assigned to one of four conditions in a 2 (weight control cue present (fitness ad) vs. absent (neutral ad)) by 2 (time scarcity vs. control) between-subjects design.

The weight control cue manipulation consisted of an ostensible review of advertising appeals. All participants reviewed three ads and reported how much they liked the advertisement overall, to what extent the ad grabbed their attention, and to what extent the ad made them want to purchase that brand. Responses to these questions were not evaluated, but rather served as filler questions to increase the validity of the cover story. For all participants, the first and third ads shown were the same (iPhone 6 and Neutrogena pink grapefruit face wash). For participants in the neutral ad condition, the second ad consisted of neutral content (Eta vacuum cleaner). For those in the weight control cue condition, the second ad consisted of a Nike plus ad showing an athletic man or woman running accompanied by the tag line "Set your goals. Track your progress. Get healthy. One step at a time." While the ad was created for the purposes of the study, the stimuli used were derived from marketing appeals from the company's own web site. The athletic ad was matched to participant gender such that female participants viewed the ad depicting the female runner while males viewed the male runner.

The manipulation of time scarcity, food choice, and task process measures (recalled feelings of time scarcity and negative affect) were identical to those

described in Study 2B. A separate online pretest (N=25) confirmed the high appeal of the unhealthy option (a freshly baked chocolate chip cookie, still warm from the oven) on a 1-to-7 scale (M = 6.34, SD = 0.77).

Results.

Data from 15 participants were excluded following prior established criteria. This left a final sample of 185.

Unhealthy preference. Preference for the chocolate chip cookie was regressed on time scarcity condition (time scarcity vs. control), ad type (fitness vs. neutral), weight-watching success, and all interactions. This analysis revealed a significant three-way interaction ($F(1, 175) = 7.29$; $p < 0.01$). This interaction was unpacked to examine the effect of time scarcity in the presence and absence of a cue to draw attention to weight control constructs.

Neutral ad (absent cue). Ad type was coded as 1 for those viewing the Nike plus ad and 0 for those viewing the vacuum cleaner ad. This dummy coding allowed for interpretation of the regression coefficients in the absence of a weight control cue. For these participants, a two-way interaction between time scarcity condition and weight-watching success emerged ($F_{\text{conditionXsuccess}}$ (1, 175) = 10.63; p = 0.001). A floodlight analysis (Spiller et al., 2013) revealed a significant effect of the manipulation in increasing preference for the unhealthy alternative for success levels of 3.4 or lower (M_{control} = 3.34, M_{scarce} = 4.48; b_{JN} = 1.14, SE = .553; $p < .05$). This JN value corresponds to roughly 0.55 standard deviations below the mean of success in this sample (M_{success} = 4.20; SD = 1.45). The manipulation did not increase unhealthy

choice for values of weight-watching success above this level. However among highly successful weight watchers (specifically at values of 5.9 and higher, corresponding to 1.2 SD above the mean of success), there was a directional reversal of the effect of time scarcity. For these highly successful individuals, the scarcity manipulation significantly *decreased* preference for the unhealthy cookie ($M_{control}$ = 4.24, M_{scarce} = 2.76; b_{JN2} = -1.49; SE = .743, $p < .05$). These results are summarized in the top panel of Figure 6.

Fitness ad (weight control cue.) Next, the effect of time scarcity was examined among those who were initially exposed to a weight control cue (the Nike plus advertisement). Weight control cue was coded as 0 for those viewing the Nike plus ad and 1 for those viewing the vacuum cleaner ad. This dummy coding allowed for interpretation of the regression coefficients among those exposed to the fitness ad.

Unlike participants who first viewed a neural ad, for those viewing a fitness ad, the effect of the time scarcity manipulation was not qualified by success ($p_{conditionXsuccess} > 0.50$). Importantly, unsuccessful weight watchers (spotlight specified at the earlier JN value of 3.4) who first viewed the fitness ad no longer increased their preference for the unhealthy option in response to a time scarcity manipulation ($M_{control}$ = 3.94, M_{scarce} = 3.93; SE = .553; $p > .9$). Thus in line with predictions, environmental cues designed to draw attention to weight control considerations successfully ameliorated the increase in unhealthful choice caused by time scarcity. The bottom panel of Figure 6 summarizes these results.

FIGURE 6: ADVERTISEMENT TYPE MODERATES THE EFFECT OF SCARCITY ON PREFERENCE

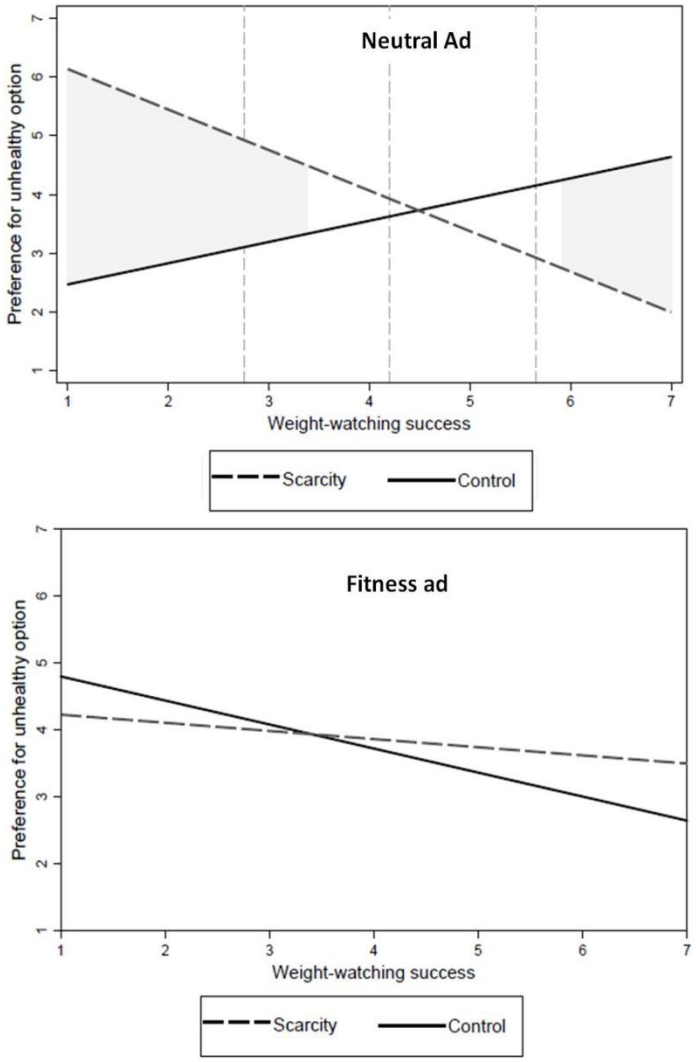

Figure 6. Study 4: Exposure to a weight control cue (a fitness ad) mitigates the effect of time scarcity among unsuccessful weight watcher. Top panel: Shaded areas represent values of weight-watching success for which unhealthy preference significantly differs between scarcity condition and control. Dotted vertical lines indicate the mean value of success in this sample (center line) as well as 1 SD below (left line) and above (right line) the mean.

Follow-up analysis. The type of ad viewed did not affect *perceptions* of scarcity produced by the manipulation (neutral ad: $M_{control}$ = 2.23, M_{scarce} = 5.41,

p<.001; fitness ad: $M_{control}$ = 2.63, M_{scarce} = 5.24, p<.001; $p_{conditionXcue}$ = NS). However, only among unsuccessful weight watchers viewing the neutral ad did feelings of scarcity translate to unhealthy choice (neutral ad: B = .319; SE= .118; p =.008; fitness ad: B = -0.100; SE= .136, p > .4). A test of moderated mediation using 5,000 bootstrapped samples (Hayes, 2013) confirmed that in the absence of a weight control cue, feelings of scarcity mediated the pathway from condition to unhealthy choice. The indirect effect, with success specified at the JN value of 3.4, was significant and did not include zero (indirect effect = 1.77; 95% CI: 0.422 to 3.12), which supports mediation.

Ruling out alternative explanations. Lastly, there was no difference between any of the conditions with respect to weight-watching success (p > .4) or time spent on the choice task. If anything, among participants who viewed the neutral ad, the scarcity condition spent marginally *more* time evaluating their choices compared to controls (neutral ad: $M_{control}$ = 26.34, M_{scarce} = 31.56; t(87) = 1.72; p = .09; fitness ad: $M_{control}$ = 34.44, M_{scarce} = 31.12; t(98) = -0.55, p > .5).

STUDY 5

In study 5, the weight control cue took the form of the presence (cue condition) or absence (control condition) of calorie information for each snack alternative. In the absence of calorie information, the prior effect of scarcity should be reproduced among unsuccessful weight watchers. However this effect should be mitigated when calorie information is presented alongside each snack alternative by directing attention to weight control.

Method

Female participants were recruited from Amazon Mechanical Turk and completed the study online using Qualtrics. The previously established exclusion criteria (hunger and weight-watching importance) were presented at the beginning of the study and served as screening questions. 278 participants passed this screening and completed the study. Participants were randomly assigned to one of four conditions in a 2 (calorie info: present vs. absent) by 2 (time scarcity vs. control) between-subjects design.

Participants completed a hypothetical choice scenario that mirrored Studies 2A-2C, with the exception that calorie information was presented for each snack option in half of the conditions (180 calories for the healthy alternative (apples with nut butter) compared to 410 calories for the unhealthy alternative (chocolate brownie)).

The manipulation of time scarcity and task process measures (recalled feelings of time scarcity and negative affect) were identical to those described in Study 2B. A separate pretest (N=25) confirmed the high appeal of the unhealthy option (a warm chocolate brownie) on a 1-to-7 scale (M = 5.92, SD = 0.94).

Results.

Unhealthy preference. Preference for the chocolate brownie was regressed on time scarcity condition (time scarcity vs. control), calorie information (present vs. absent), weight-watching success, and all interactions. As in previous studies, hunger was included as a covariate. Because the sample was comprised solely of females,

gender was not used as a covariate. The analysis revealed a marginally significant three-way interaction ($F(1, 269) = 3.42$; $p = 0.065$). This interaction was unpacked to examine the effect of time scarcity in the presence and absence of calorie information.

No calorie info. Calorie information was coded as 1 for present and 0 for absent. For participants who did not receive calorie information, a two-way interaction between time scarcity condition and weight-watching success emerged ($B = -1.02$; $F(1, 269) = 4.48$; $p < 0.05$), mirroring prior studies. A floodlight analysis (Spiller et al., 2013) revealed that scarcity increased preference for the unhealthy brownie for success levels of 3.2 or lower ($M_{control} = 3.54$, $M_{scarce} = 4.86$; $b_{JN} = 1.33$; SE = .661; $p <$ .05). This JN value corresponds to roughly 1.14 standard deviations below the mean of success in this sample ($M_{success} = 4.49$; SD = 1.13). The manipulation did not increase unhealthy choice for values of weight-watching success above this level. However among highly successful weight watchers (specifically at values of 6 and higher, corresponding to 1.3 SD above the mean of success), there was a directional reversal of the effect whereby time scarcity significantly *decreased* preference for the unhealthy option ($M_{control} = 4.97$, $M_{scarce} = 3.44$; $b_{JN2} = -1.53$; SE = .774; $p <0.05$). These results are summarized in the top panel of Figure 7.

Calorie info. Calorie information was recoded as 0 for present and 1 for absent. Among those who were given calorie information for each option, the effect of the time scarcity was no longer significant, regardless of success level ($p_{conditionXsuccess} >$ 0.80). Unsuccessful weight watchers (spotlight specified at the earlier JN value of 3.2) no longer increased their preference for the unhealthy option in response to a scarcity manipulation ($M_{control} = 4.19$, $M_{scarce} = 4.02$; SE = -0.17; $p > .8$). In line with

predictions, directing attention to cues associated with weight control successfully ameliorated the increase in unhealthful choice caused by time scarcity. The bottom panel of Figure 7 summarizes these results.

FIGURE 7: CALORIE INFORMATION MODERATES THE EFFECT OF SCARCITY ON PREFERENCE

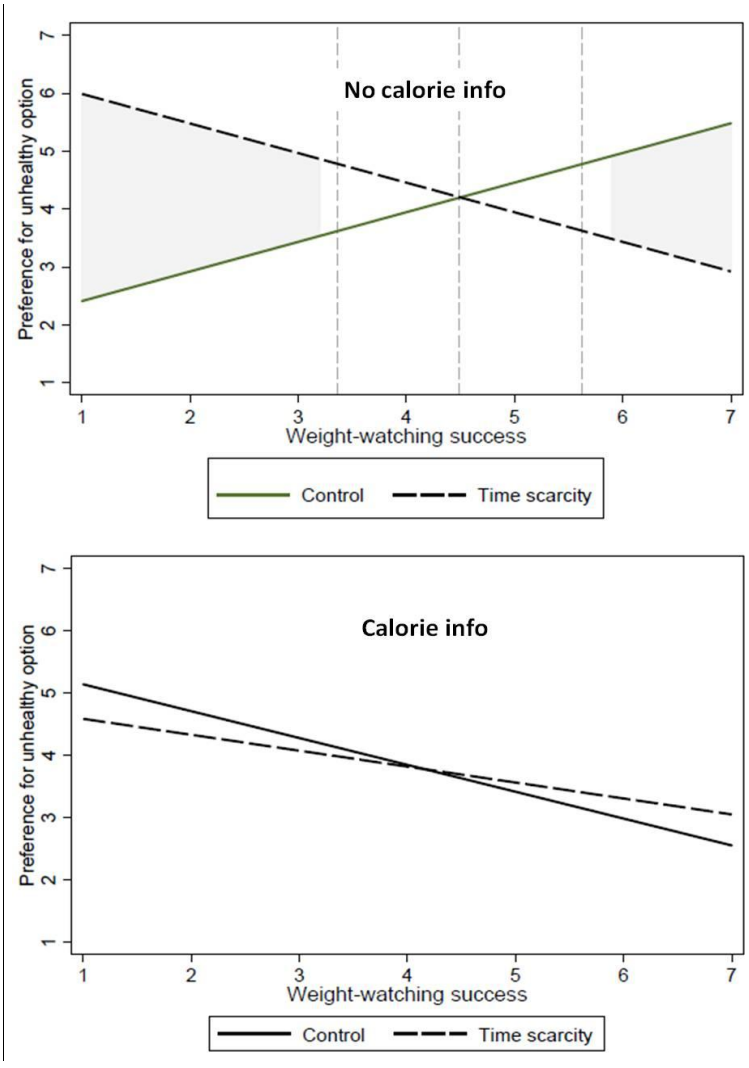

Figure 7. Study 5: Calorie information mitigates effect of scarcity on preference for unsuccessful weight watchers. Top panel: Shaded areas represent values of weight-watching success for which unhealthy preference significantly differs between scarcity condition and control. Dotted vertical lines indicate the mean value of success in this sample (center line) as well as 1 SD below (left line) and above (right line) the mean.

Discussion

The results of Studies 4 and 5 provide additional evidence as to why time scarcity increases preference for unhealthy foods by demonstrating how the effect can be switched off. Consistent with a theory that time scarcity directs attention to cues that signal eating enjoyment, redirecting participants' attention to weight control cues (fitness images, calorie information) extinguished the effect of scarcity on unhealthy food preference among unsuccessful weight watchers. Importantly, in Study 4 the time scarcity manipulation elicited feelings of time scarcity *regardless* of cue exposure. However only in the absence of a weight control cue did these feelings translate into unhealthy choice for relatively unsuccessful weight watchers.

Furthermore, Study 5 produces supporting evidence against an alternative "harsh environment" hypothesis (Laran and Salerno, 2013). Such a hypothesis posits that under times of economic hardship (e.g., a recession or famine) individuals gravitate toward higher calorie options that will help to provide sustenance and buffer them against tough times. This alternative account would predict that increasing the salience of (high) calorie information would *intensify* the scarcity effect, when in fact the opposite (i.e., attenuation) was found.

STUDY 6

Thus far, Studies 3-5 have provided initial evidence for the proposed process using a proxy for attention (the content of participants' deliberations pertaining to eating enjoyment and weight control mid-choice; Study 3); and moderating evidence

(redirecting attention to cues that signal the competing weight control goal to mitigate the effect; Studies 4 and 5). Study 6 seeks out further evidence of attentional allocation towards eating enjoyment by using participants' reaction times as a measure of attention during a dot probe task. The dot probe has been successfully used in prior research to identify attentional biases for food cues in a variety of subpopulations (e.g., Castellanos et al., 2009; Werthmann et. al., 2011; Nijs et al., 2010; Kemps et al., 2014; Seage and Lee, 2017).

Instead of reported success in weight watching, Study 6 used a more focused aspect of success – eating disinhibition. Disinhibition is most notably characterized by a lack of self-regulation stemming from heightened sensitivity to the rewarding aspects of food. While it covers a host of eating behaviors, specific examples include binge eating, unhealthy food choices, and a low awareness of and response to satiety signals (Lattimore, Fisher, and Malinowski, 2011). Because scarcity is theorized to promote unhealthy choice by drawing attention to cues signaling eating enjoyment, individuals scoring higher in eating disinhibition should be especially vulnerable.

A visual dot probe task (Miller and Fillmore, 2010; Tapper, Pothos, and Lawrence, 2010; Seage and Lee, 2017) was used to examine whether disinhibited eaters allocate greater attention to high caloric foods. Attention is indicated by the speed with which participants indentify the location of a probe that follows a pair of stimuli. It is generally assumed that probe detection should be faster when the probe follows a stimulus to which attention has already been drawn. For disinhibited eaters, this would be high calorie foods.

In the task, two images were briefly presented side by side, followed by a probe where one of the stimuli had been. In this study, the probe took the form of an "X" rather than a dot as the task name implies. Some trials involved a food (high or low calorie) picture and a neutral picture, and others contained two neutral pictures. Participants had to indicate using the "D" (left) or "K" (right) key of their keyboard to indicate where the probe had previously appeared. Response time (RT) was used to calculate attentional bias. Faster RTs on trials where the probe followed in the location of a food picture, compared with trials when it followed one of two neutral stimuli indicated increased attention to food stimuli. Bias scores were calculated separately for trials where the food image consisted of a high vs. low calorie food. In line with prior research (Tapper, Pothos, and Lawrence, 2010) an attentional bias was predicted for high calorie foods, irrespective of condition or disinhibition level (i.e., participants should be on average faster to identify the probe when it is preceded by a high calorie food, compared to a household item). However the magnitude of bias for high calorie foods was predicted to be greater in the scarcity condition among disinhibited eaters. Attentional bias was not predicted for low calorie foods, which should not elicit the same eating enjoyment cues.

Method

Participants were recruited from Amazon Mechanical Turk and completed the study online using Qualtrics and the online reaction time measurement software Inquisit. Participants were randomly assigned to one of two conditions in a scarcity vs. control between-subjects design. 179 participants (54% female; M_{age} = 34.8) passed the initial filter questions (current hunger and importance of weight watching both

greater than 1) and completed all portions of the study with complete data (an additional five participants encountered software issues with the Inquisit task and could not be included in the final sample).

In the study, participants first completed the 9-item Disinhibited Eating subscale of the Three Factors Eating Questionnaire ("TFEQ-D"; Stunkard and Melleck, 1985; alpha = 0.89) followed by a set of unrelated filler questions. The TFEQ-D includes items such as "Sometimes things just taste so good that I keep on eating even when I am no longer hungry" and "Sometimes when I start eating, I just can't seem to stop". Higher responses on this scale reflect greater sensitivity to a food's palatability and difficulty with ensuing self-regulation (Yeomans, Leitch, and Mobini, 2008). Next, participants completed the anagram manipulation of time scarcity followed by the visual dot probe task (script adapted from Miller and Fillmore, 2010) using Inquisit 4 Web Edition by Millisecond.

The test stimuli in the dot probe task consisted of 40 pairs of color pictures. Ten pairs were a calorie dense food and a household item; ten were a low calorie food and a household item, and twenty were two household items. The household items were specifically selected so as not to relate to a food context (e.g. food preparation or cooking). An additional 10 household items were used to create practice trials (see Appendix for exact images used).

During the task, a fixation point (a "+" symbol) first appeared in the middle of the screen for a duration of 500 ms. After the presentation of the fixation point, a picture pair appeared on screen for 500 ms, after which the "probe" (in this case an

"X") appeared in the position where one of the stimulus had been. Participants pressed the "D" or "K" key of their keyboard as quickly as possible to indicate the location (left and right, respectively) where the probe had previously appeared. Participants' response time (RT) in milliseconds (ms), as well as their accuracy was recorded by the measurement software.

The survey consisted of a round of 10 practice trials, after which participants completed the main experiment, consisting of 160 trials (80 critical trials, 80 matched neutral trials). There were four randomized presentations of each of the 40 pairs of images: e.g., food (high or low calorie) stimulus shown on left, followed by a probe on the left; food stimulus on left, followed by a probe on the right; food stimulus shown on the right, followed by a probe on the right and food stimulus show on right followed by a probe on the left). After completing the dot probe task, participants were directed back to Qualtrics for debriefing and final demographic questions and received their completion code.

Results

The simplicity of the task (indicating the location of a probe) yielded a high accuracy (M=0.95, SD = .118). To reduce the influence of participants who may not have taken the task seriously (especially a concern given the study's online nature) analysis was further constrained to those participants with an overall accuracy score of .70 or higher. This eliminated a further 11 participants (6%), leaving a final sample of 168. Inclusion of these participants does not change the overall pattern of the results or the conclusions drawn below.

Only trials with correct responses (% $correct_{control}$ = 97.3%; % $correct_{scarce}$ = 97.7%) were included in the data analysis. Following previously validated procedures (Miller and Fillmore, 2010) RT for correct choices that were >100 ms were analyzed. Attentional bias scores were calculated for each participant by subtracting the mean RT for probes replacing food items (calculated separately for high and low calorie) from the mean RT for probes replacing neutral items. Thus positive values would reflect an attentional bias favoring (i.e., faster response times for) a food stimulus.

Attentional bias. A repeated measures mixed model was used to examine attentional bias scores as a function of scarcity condition, food type, and disinhibition. Bias score was regressed on food type (a within-subject repeated measure), scarcity condition (between-subjects), disinhibition (continuous), and all interaction terms. Values greater than zero indicate a positive attentional bias for food stimuli. As in other food studies, hunger level (continuous) and gender (coded 1 for female, 0 for male) were included as covariates.

The regression revealed a significant three-way interaction (B_{INT} = -6.04; $F(1, 158) = 5.90$; $p = 0.015$) and a simple main effect of stimulus type. As may be expected from the higher motivational value of calorie dense foods, higher attentional bias scores were observed on average (i.e., irrespective of condition or disinhibition level) for high calorie compared to low calorie foods ($M_{high\text{-}calorie}$ = 9.36, $M_{low\text{-}calorie}$ = -2.04, SE = 1.78; $p < .001$).

On trials where picture pairs contained calorie dense food items, bias scores were significantly greater than zero on average (M = 9.36; $t(167) = 7.41$; $p < .001$).

However this was qualified by a significant interaction between disinhibition and condition (B_{INT} = 3.48; $F(1, 158) = 4.04$; $p < 0.05$). While bias was evident for both conditions (i.e., mean RT for probes replacing neutral items - mean RT for probes replacing high calorie items was significantly greater than zero for both conditions), bias increased at higher levels of disinhibition within the scarcity condition (B= 2.97; $F(1, 158) = 6.10$; $p = .015$). Within the control condition, there was no such association between disinhibition and attentional bias (B= -4.66; $p > .7$). A floodlight analysis (Spiller et al., 2013) based on a fitted linear regression model revealed that at disinhibition levels of 4.8 and higher, the scarcity condition exhibited greater bias than controls ($M_{control}$ = 7.32, M_{scarce} = 13.82; b_{JN} = 6.49; SE = 3.27; p = .049). This value corresponds to roughly 0.84 standard deviations above the mean of disinhibition in this sample ($M_{disinhibition}$ = 3.58; SD = 1.44). There was no significant difference in bias scores between conditions for values of disinhibition below this level. This result is summarized in the left panel of Figure 8.

On trials where picture pairs contained low calorie food items however, bias scores were on average not significantly different than zero (i.e., participants did not exhibit attentional bias towards low calorie foods; $M_{low\text{-}calorie}$ = -2.04; $t(167) = -1.62$; $p > .10$). There was no difference between conditions (neither as a main effect, nor qualified by an interaction with disinhibition) in bias score for low calorie foods (all ps NS). This suggests that in line with predictions, scarcity selectively directs attention towards cues that signal eating enjoyment (i.e., high calorie, but not low calorie stimuli). This result is summarized in the right panel of Figure 8.

FIGURE 8: ATTENTIONAL BIAS FOR HIGH (LEFT PANEL) VS. LOW (RIGHT PANEL) CALORIE FOODS

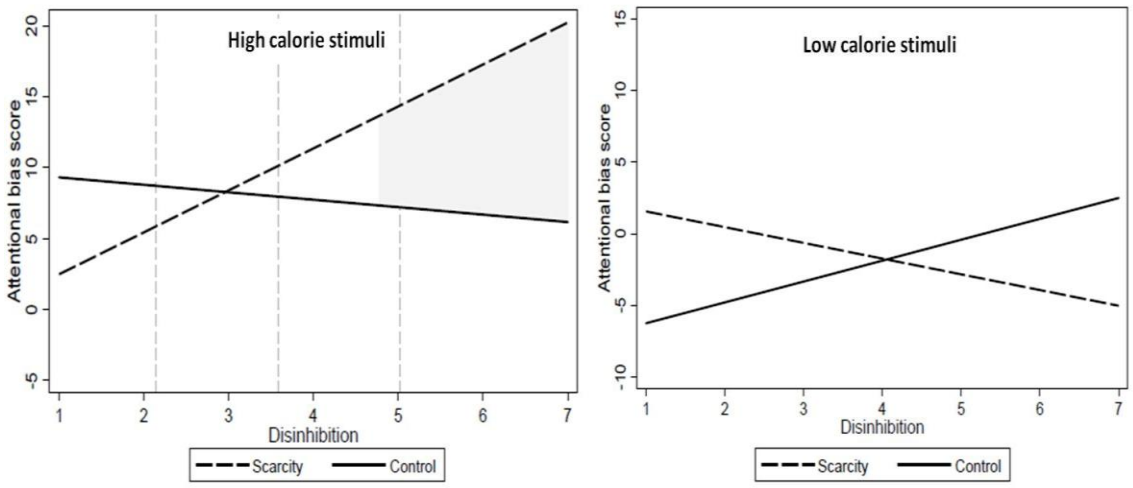

Figure 8. Study 6: Attentional Bias for high (left panel) vs. low (right panel) foods. Left panel: Shaded area represents values of disinhibition for which the scarcity condition increases attentional bias for high calorie foods relative to controls. Dotted vertical lines indicate the mean value of disinhibition in this sample (center line) as well as 1 SD below (left line) and above (right line) the mean.

Follow-up analysis: Using an approach followed by Koster et al. (2006), I examined whether greater attentional bias among disinhibited eaters exposed to scarcity reflected facilitated attention to eating enjoyment cues or delayed disengagement from them. RTs for congruent (probe appears on the same side as the high calorie stimuli) and incongruent (probe appears on the opposite side as the high calorie stimuli) trials were compared to mean RTs for matched neutral trials. Faster responses on congruent trials would suggest that attentional bias reflected enhanced attention to eating enjoyment cues. Conversely slower RTs on incongruent trials compared to neutral trials suggests that attentional bias derives from a difficulty disengaging from desirable food cues. The analysis provided evidence of facilitated

attention, not inhibited disengagement. Facilitated attention score (neutral RT - congruent high cal trials RT) was regressed on scarcity, disinhibition, and their interaction, with gender and hunger as covariates. Mirroring the results of the main analysis, the interaction between disinhibition and condition was significant (*B*= 5.14; $F(1, 158) = 6.45$; $p = .012$). Scarcity promoted facilitated attention to high calorie foods for individuals high in disinhibition (spotlight analysis revealed a significant effect of scarcity condition at a JN value of 4.3 and higher). Replacing disengagement score (neutral RT - incongruent high cal trials RT) as the DV yielded no evidence that scarcity promoted greater difficulty disengaging from high calorie stimuli (all *p*s NS). This finding of facilitated attention to rewarding food cues is supported by prior research (Seage and Lee, 2017).

Discussion

In combination, Studies 3-6 provide supporting evidence of the process through which scarcity promotes the prioritization of an eating enjoyment goal, by directing participants' attention to cues that signal eating enjoyment (as opposed to weight control). Under scarcity, unsuccessful weight watchers reported a greater emphasis on taste and enjoyment considerations mid choice (Study 3), and disinhibited eaters exhibited a greater attentional bias for calorie rich foods as measured via reaction times during a dot probe task (Study 6). Furthermore, the effect of scarcity on unhealthy preference was successfully extinguished by directing participants' attention to cues, specifically fitness images (Study 4) and calorie information (Study 5), that support the competing weight control goal.

CHAPTER 4

EXTENSION TO OTHER DOMAINS (STUDIES 7-9)

Having uncovered a greater understanding into the process through which time scarcity influences the prioritization of competing goals in a food choice context, a final set of studies (Studies 7-9) was carried out to extend the domain of the current paradigm, in regards to both its source and effect. Studies 7 and 8 extend the effect of scarcity to another form of goal conflict, namely impulsive spending. Study 9 revisits the domain of food choice but branches away from the domain of time scarcity, instead using stock scarcity in an online shopping context. The figure below provides an overview of this domain extension and the contribution of each subsequent study.

FIGURE 9: GENERALIZING TO ANOTHER FORM OF GOAL CONFLICT AND SCARCITY

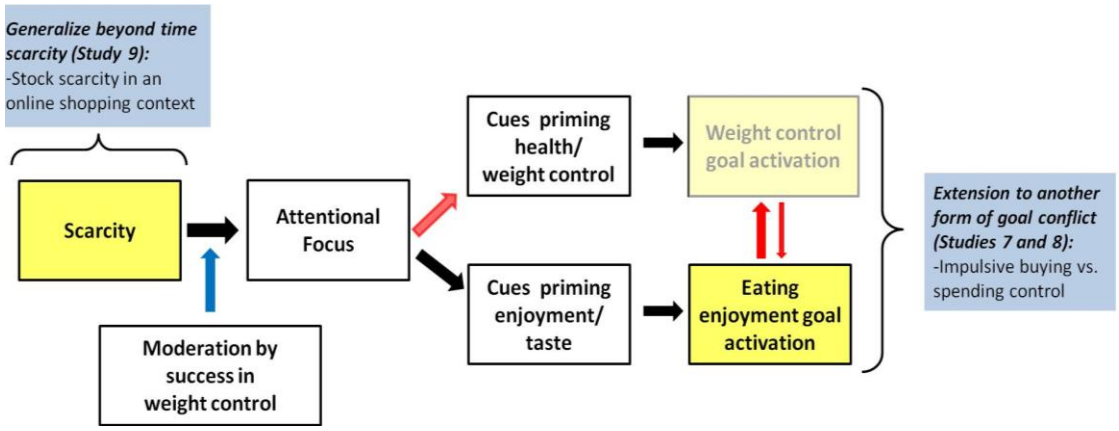

Figure 9: Studies 7-9. Overview of the domain extension to another form of goal conflict and scarcity. Studies 7 and 8 extend the effect of scarcity to the conflicting goals of impulsive spending vs. spending control. Study 9 generalizes beyond time scarcity to examine scarcity of stock in an online shopping scenario.

STUDIES 7 and 8

Impulse spending has been characterized in the literature as a self-control conflict involving the opposing forces of 1) a desire to buy and 2) the ability or desire to exercise control over this urge (Hoch and Loewenstein, 1991). Studies 7 and 8 examined the effect of time scarcity within the domain of impulsive spending (a proxy for the competing goals to spend money to acquire goods vs. exhibit self-control in spending). Analogous to the specification of the effect among unsuccessful weight watchers, it was predicted that scarcity would increase spending for those individuals who struggle with curbing superfluous spending.

Method

In Study 7, 178 participants (47% female; M_{age} = 36.0) were recruited from Amazon Mechanical Turk and completed the study online using Qualtrics. They were randomly assigned to either a time scarcity or control condition (anagram manipulation used in prior studies) in a between-subjects design.

Following the scarcity manipulation, participants moved on to an ostensibly separate "consumer survey" in which they were asked to indicate their current willingness to pay for 12 products (adapted from Vohs and Faber, 2007; Touré-Tillery and Fishbach, 2015). Previous research has demonstrated a high correlation of similar pricing tasks with actual spending behaviors (Carson et al., 1996), allowing willingness to pay to serve as proxy for the extent to which participants "splurged" versus exercised restraint in the task. The specific items were as follows: wallet, toaster, vacuum, dress shoes, sunglasses, designer jeans, wristwatch, backpack,

electric toothbrush, travel umbrella, leather belt, and bath towel. Following the protocol of Touré-Tillery and Fishbach (2015) the products were described by the item name in text only, without images, to promote gender neutrality of the items. An additional instruction was provided to increase task relevance -- to envision that the product in question was of a brand and style that the participant liked. Items were shown one at a time, in randomized order, and participants entered their WTP for each in a text box. Following a filler survey intended to separate the dependent variable from the moderating variable measure, participants completed Rook and Fischer's (1995) 9-item measure of buying impulsivity (e.g., "'Just do it' describes the way I buy things"; "Sometimes I am a bit reckless about what I buy") using a 7-point scale (1 = strongly disagree; 7 = strongly agree). Responses across the 9 items were averaged to form an index of buying impulsiveness (alpha = 0.91). Lastly, participants provided their demographic information and a debrief assessment. To ensure that participants held at least some desire to exercise self-control in spending (so as to allow for a goal conflict to present itself), I also assessed participants' assigned importance of watching their spending at the end of the survey (Touré-Tillery and Fishbach, 2015; "How important is it for you to watch your spending?"; "How important is it for you to save money?" (1=not at all, 7=very much)). Ratings were high among participants (M = 6.12; SD = 0.91) and the minimum response to this measure (averaging both items) was 3.5. As such no participants were excluded on the basis of an absent desire to exercise self-control in spending.

Results

WTP. Price assignments across all items were aggregated into an overall WTP index. WTP was regressed on condition (coded 1 for time scarcity, 0 for control), spending self-control (continuous), and their interaction. Gender (coded 1 for female, 0 for male) was included as a covariate. While the predicted interaction was observed between scarcity condition and buying impulsiveness (see below for a further description of this result) further analysis revealed a qualification of this effect based on participant gender ($B_{3\text{-way}}$ = -176.4; $F(1, 170) = 4.58$; $p = 0.034$). Following this unanticipated result, the effect of scarcity as a function of buying impulsiveness was examined separately for men and women. This was done by altering the coding of the dummy variable for gender in the model, namely setting the gender being examined equal to 0.

Among males (gender dummy set equal to 0 if participant was male and 1 if female) the expected relationship between scarcity and buying impulsiveness surfaced (B_{INT} = 144.2; $F(1, 170) = 8.03$; $p < 0.01$). A floodlight analysis (Spiller et al., 2013) based on a fitted linear regression model was used to identify the range of buying impulsiveness for which the time scarcity manipulation significantly increased WTP. Consistent with predictions, among those relatively high in impulsiveness, scarcity led to greater price assignments. The analysis revealed a Johnson-Neyman point at impulsiveness levels of 3.9 and higher ($M_{control}$ = \$453.88, M_{scarce} = \$605.51; b_{JN} = 151.62; SE = 76.86; p = .05). This value corresponds to roughly 0.9 standard deviations above the mean of impulsiveness in this sample ($M_{impulsiveness}$ = 2.83; SD = 1.16). However at low levels of impulsiveness (1.6 and below, corresponding to 1.1

SD below the mean), the opposite effect occurred in which scarcity decreased WTP compared to controls ($M_{control}$ = \$497.49, M_{scarce} = \$317.42; b_{JN2} = -180.07; SE = 91.23; p = .05). This result is summarized in the left panel of Figure 10.

FIGURE 10: EFFECT OF SCARCITY ON WTP AMONG MALES (LEFT PANEL) AND FEMALES (RIGHT PANEL)

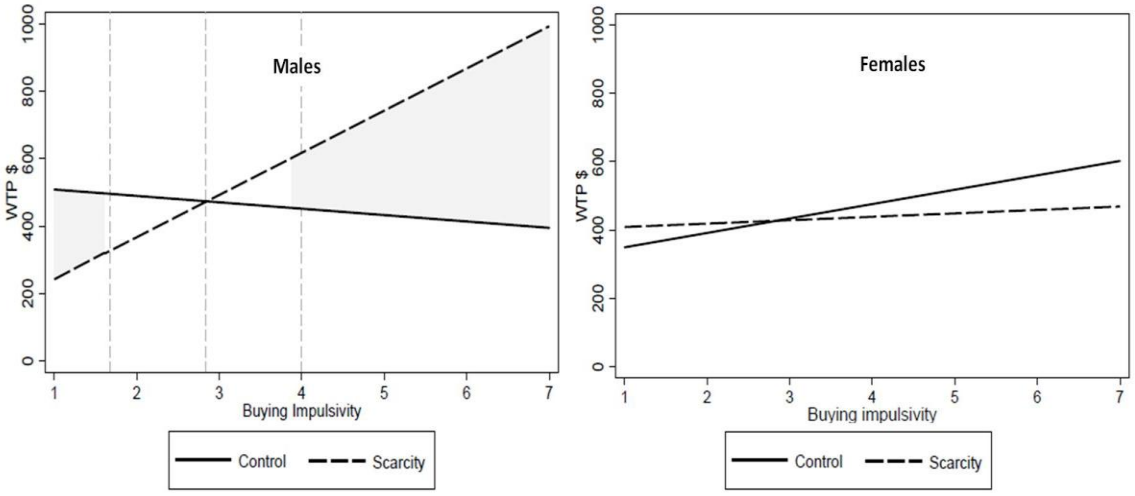

Figure 10. Study 7: Scarcity increases WTP among males high in buying impulsivity (left panel) but not females (right panel) Left panel: Shaded areas represent values of impulsivity for which WTP significantly differs between scarcity condition and controls. Dotted vertical lines indicate the mean value of impulsivity in this sample (center line) as well as 1 SD below (left line) and above (right line) the mean.

However among females (gender dummy set equal to 0 if participant was female and 1 if male) there was no effect of scarcity on spending, neither as a main effect nor as an interaction with impulsiveness (all ps > .30). This result is summarized in the right panel of Figure 10 above.

The original analysis, conducted without an interaction term for gender and therefore examining the average effect across both men and women, yielded an

analogous pattern (i.e., a significant interaction between impulsivity and condition: $B_{INT} = 80.25$; $F(1, 173) = 4.02$; $p < 0.05$). However the level of impulsiveness at which scarcity significantly increased spending was higher when looking across genders than looking at males alone (Johnson-Neyman = 6.2; roughly 2.8 standard deviations above the mean of buying impulsiveness in this sample) ($M_{control} = \$456$, $M_{scarce} = \$684$; $b_{JN} = 228$; SE = 114.4; $p < .05$).

Outlier analysis. To explore the possibility of outliers driving the results, the analysis was repeated after excluding price assignments that exceeded the 99th percentile for each item, and also reassigning the stated outlier price to the 99th percentile value. Neither changed the outcome of the results.

Discussion

Study 7 yielded an unexpected interaction with gender – the predicted interaction between scarcity and buying impulsivity was present among male participants only. While unpredicted a priori, this finding is consistent with a 2014 survey of 1,000 US adults on impulse spending (Merzer, 2014). While men and women both engage in impulse spending at roughly equal rates, the $ value of unplanned purchases differed significantly between genders. Men were significantly more likely than women to spend amounts exceeding $1000, while women were significantly more likely to cap their spending at $25. The similar tendency for men and women to engage in impulsive spending may explain why women's self perceptions of buying impulsiveness were not significantly lower than males in this study: ($M_{men} = 2.89$, $M_{women} = 2.74$; SE = 0.179; $p > .30$). However the general

tendency for women to curb their spending amount may explain why an effect of scarcity did not surface among females.

STUDY 8

Following the absence of a scarcity effect among females in Study 7, a sample of male participants (N=180; M_{age} = 36.3) was recruited for Study 8. While the follow-up analysis in Study 7 did not indicate any issue pertaining to an undue influence of outliers, nonetheless an alternate measure of impulsive spending (a series of binomial choices to purchase or not purchase a given item) was used to reduce this possibility. In addition, to test the generalizability of the moderating variable, a second measure was collected and tested in addition to buying impulsiveness. This measure is self-control in spending (Haws et al., 2012).

Method

180 male participants were recruited from Amazon Mechanical Turk and completed the study online using Qualtrics. Participants first completed the anagram manipulation of time scarcity used in prior studies.

Following the scarcity manipulation, participants were presented with a buying scenario adapted from Vohs and Faber (2007). In the scenario, the participant was asked to imagine that he is walking down the street and finds a $20 bill. Later on his walk, he passes a garage sale selling various items under $20. The sale accepts cash only, and the new found $20 bill is the only cash the participant has on his person. The participant is instructed that he can use this cash to purchase items at the sale, or save

the bill to spend later. If his purchase total is less than $20, the participant will keep any remaining change.

Participants were then shown a list of 12 products available for purchase at the garage sale (e.g., bottle opener, key chain, mug, coasters, magnet, playing cards; see Appendix for the full list of items and images used). All items were described as "in excellent, 'like new' condition" to stem potential concerns of poor or second-hand quality. Items were displayed simultaneously on screen, rather than one at a time, to prevent participants withholding purchase and saving their money for the prospect of a more desirable item to come. Each item was presented with its price (ranging from $1.79 to $6.49) and the order of the items on the page was randomized. Ps indicated their decision for each item by selecting one of two options: "Buy this item" or "Do not buy this item".

Following a brief intervening survey consisting of filler questions, participants completed the measure of buying impulsiveness as in Study 7. This was followed by Haw et al.'s (2012) 10-item measure of consumer spending self-control (e.g., "I am able to resist temptation in order to achieve my budget goals."; "When I go out with friends, I keep track of what I am spending") using a 7-point scale (1 = strongly disagree; 7 = strongly agree). Responses across the two scales were separately averaged to form an index of buying impulsiveness and of spending self-control, respectively ($alpha_{impulsive}$ = .90; $alpha_{cssc}$ = 0.92). As would be expected, these measures were highly correlated albeit inversely (r = -0.71). Lastly, participants provided their demographic information and rated the importance of spending control as in Study 7. Once again, values for this measure were high in the sample (M= 6.194;

SD=.864) and the minimum response to this measure (averaging both items) was 2.5. This precluded eliminating any participants due to the absence of a desire to control their spending.

Results

Spending. For any items that participants expressed a desire to purchase, the item prices were summed to determine the total $ spent for each participant. In the analysis below, the raw spending amount was used even if it exceeded the amount stated in the scenario (the task did not have a way of alerting participants if the items they selected to purchase exceeded $20 in total). A separate analysis that capped expenditure at $20 for any participants (n=13) exceeding the scenario threshold did not significantly alter the results below.

Spending amount was first regressed on condition (coded 1 for time scarcity, 0 for control), spending self-control (continuous), and their interaction. While there was no main effect of condition, a significant interaction term surfaced between spending self-control and condition (B_{INT} = -3.10; $F(1, 176) = 6.86$; $p < 0.01$). A floodlight analysis (Spiller et al., 2013) revealed a Johnson-Neyman point at spending self-control levels of 5.35 and lower. There was a significant effect of the manipulation in increasing purchase quantity for self-control values less than or equal to 5.35 ($M_{control}$ = \$5.92, M_{scarce} = \$8.40; b_{JN} = 2.48; SE = 1.23; p = .055). This value corresponds to roughly 0.3 standard deviations below the mean of spending self-control in this sample (M_{cssc} = 5.68; SD = 1.00). This result is summarized in the left panel of Figure 11.

FIGURE 11: EFFECT OF SCARCITY ON SPENDING AS A FUNCTION OF SPENDING SELF-CONTROL (LEFT) AND IMPULSIVITY (RIGHT)

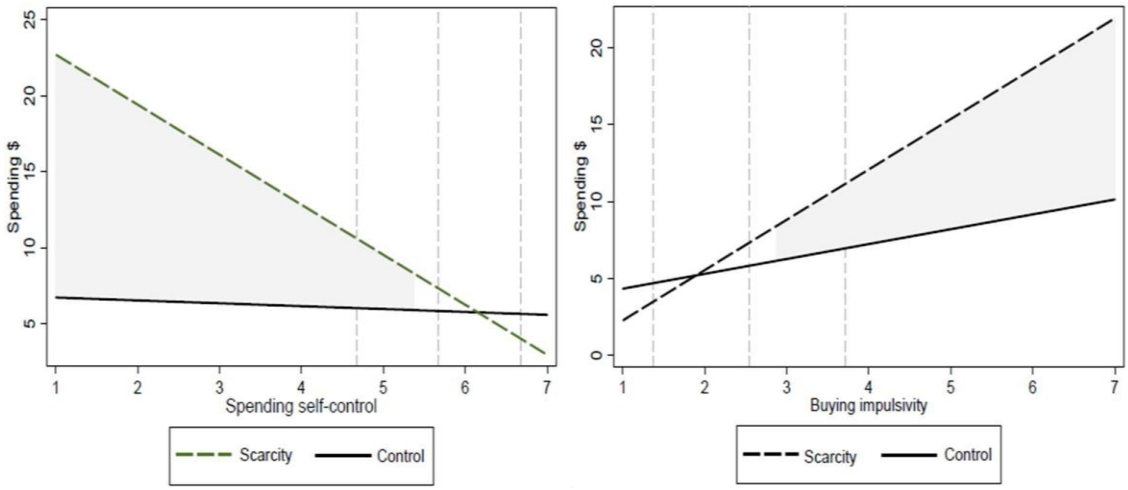

Figure 11.Study 8: Scarcity increases spending among males low in spending self-control (left panel) and high in buying impulsiveness (right panel) Shaded areas represent values of spending self-control (left panel) and buying impulsivity (right panel) for which the scarcity condition increases spending relative to controls. Dotted vertical lines indicate the mean value of self-control and impulsivity in this sample (center line in each panel) as well as 1 SD below (left line in each panel) and above (right line in each panel) the mean.

The analysis was repeated using buying impulsiveness as a moderator, and a similar (albeit mirrored pattern) resulted. There was a significant interaction between buying impulsiveness and condition (B_{INT} = 2.31; $F(1, 176) = 5.66$; $p = 0.018$). A floodlight analysis (Spiller et al., 2013) revealed a Johnson-Neyman point at buying impulsiveness levels of 2.9 and higher ($M_{control}$ = \$6.17, M_{scarce} = \$8.49; b_{JN} = 2.32; SE = 1.18; $p = .052$). This value corresponds to roughly 0.30 standard deviations above the mean of buying impulsiveness in this sample ($M_{impulsive}$ = 2.54; SD = 1.17). This result is summarized in the right panel of Figure 11 shown above.

Discussion

The results of Study 8 replicate those of Study 7 within a male-only sample. Taken together, they extend the effect of scarcity to a form of goal-conflict beyond weight control and eating enjoyment. They use two different measures of impulsive spending as a proxy for the conflicting goals of 1) a desire to buy (indicated by higher WTP and higher $ spending) and 2) the desire to exercise control over this urge (indicated by lower WTP and lower $ spending) (Hoch and Loewenstein, 1991). I demonstrate that scarcity increases unplanned purchase relative to controls, however only among those who struggle with exercising control in spending (males high in buying impulsiveness, and low in spending self-control). The qualification of the scarcity effect is analogous to the pattern observed within a food choice domain.

Having extended the effect of scarcity to another form of goal conflict, Study 9 revisits the domain of food choice but branches away from the domain of time scarcity. Instead it examines the occurrence of scarcity in a highly relevant consumer domain – stock scarcity in an online shopping scenario.

STUDY 9

Study 9 used an online shopping scenario in which items were either in-stock (control condition) or low and out of stock (scarcity condition). Online shopping is a highly relevant consumer context, with 41% of shoppers making an online clothes purchase in a recent 6-month period, and 60% visiting a website prior to making a purchase (Nielsen, 2016). While stock outs are often an unintentional consequence of

demand exceeding inventory, scarcity is also deliberately used by some companies as a marketing tactic. For example, the highly popular athleisure companies "Lululemon" and "Fabletics" have built business models around a frequent style turnover that requires consumers to act fast or risk missing out (Mattioli, 2012). I predicted that partaking in a hypothetical shopping experience in which items were low or out of-stock (scarcity condition), compared to stocked (control condition), would replicate the effect of time scarcity on food choice.

Method

195 female participants were recruited via Mechanical Turk and completed the study online using Qualtrics. The study was limited to female participants to increase relevance of the manipulation context – online shopping for clothes. Participants were randomly assigned to a stock scarcity condition or control condition in a between-subjects design. They first completed an online shopping scenario that comprised the scarcity manipulation. Participants in both conditions were instructed to imagine that they were purchasing a birthday gift online (a jacket) for their friend. A friend was chosen as the target, rather than the participant, to minimize the effect of differences in personal style and sizing across participants. Participants were informed that their friend had previously picked out this particular jacket online, but despite really loving it could not justify purchasing it for herself. The participant has found the jacket online and decided that it will make the perfect gift.

Participants were taken through the scenario of selecting their friend's size (a Medium) from a drop down menu, and adding the jacket to their shopping cart (see

Appendix for exact instructions and images used). In the scarcity condition, the drop down menu displayed many items as out of, or low in stock. The desired size (a Medium) was listed as low in stock (but still available) to prevent differences in frustration or disappointment between the two conditions. Participants were prompted to elaborate on this scenario and any thoughts or feelings they were having at that moment.

Following the manipulation, participants completed the same snack choice as Study 5 (apples and nut butter vs. chocolate brownie) followed by an unrelated brief survey comprised of filler questions. They then completed the Disinhibited Eating subscale of the TFEQ as in Study 6. Lastly, importance of weight watching, hunger, and demographic variables were assessed as in prior food studies.

Results

Fifteen participants were omitted from analysis based on the exclusion criteria stipulated previously for all food studies, leaving a final sample of 180.

Unhealthy preference. Preference for the unhealthy snack (the chocolate brownie; continuous) was regressed on condition (coded 1 for stock scarcity, 0 for control), eating disinhibition (continuous), and their interaction. As in all other food choice studies, hunger level (continuous) was included as a covariate (since the study was limited to females, gender was not included as a covariate). While there was no main effect of condition, a significant interaction term surfaced between disinhibition and condition ($B_{INT} = 0.554$; $F(1, 175) = 4.49$; $p = 0.03$). A floodlight analysis (Spiller et al., 2013) based on a fitted linear regression model was used to identify the range of

disinhibition values for which the stock scarcity manipulation significantly increased unhealthy preference relative to controls. Consistent with predictions, among more disinhibited eaters, the manipulation shifted preferences towards the unhealthy snack option. Specifically, the analysis revealed a Johnson-Neyman point at disinhibition levels of 4.25 and higher ($M_{control}$ = 3.64, M_{scarce} = 4.40; b_{JN} = 0.765; SE = 0.386; p = .05). This value corresponds to roughly 0.36 standard deviations above the mean level of disinhibition in this sample ($M_{disinhibition}$ = 3.73; SD = 1.44). The effect of the manipulation did not reach significance for values of eating disinhibition below this level. This result is summarized in Figure 12.

FIGURE 12: EFFECT OF STOCK SCARCITY ON PREFERENCE

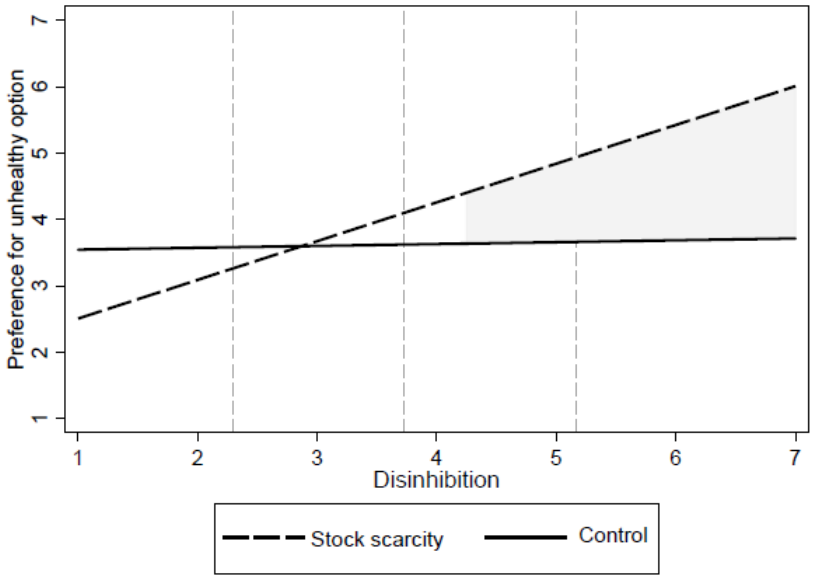

Figure 12. Study 9: Stock scarcity promotes unhealthy choice among disinhibited eaters. Shaded area represents values of disinhibition for which the scarcity condition increases unhealthy preference relative to controls. Dotted vertical lines indicate the mean value of disinhibition in this sample (center line) as well as 1 SD below (left line) and above (right line) the mean.

Discussion

Study 9 replicates the effect of time scarcity on food choice by using a manipulation that is particularly relevant to today's modern consumers – stock outs in an online shopping context. Compared to controls, participants who completed a shopping scenario in a low stock environment exhibited a greater preference for an unhealthy food item. As with prior studies, this effect was qualified by participants' sensitivity to eating enjoyment cues (measured in this study as eating disinhibition). Among disinhibited eaters, an effect of scarcity emerged, but not among those low in this measure. The timing measures taken in earlier studies refute the alternative explanation that a time scarcity manipulation merely promotes rushing and reduces deliberation. However the use of a time independent manipulation of scarcity in Study 9 provides further evidence that the effect is indeed a product of scarcity, not simply time restraints per se.

CHAPTER 5

GENERAL DISCUSSION

A commonly cited obstacle to consumer well-being is an insufficiency of resources. A lack of money, time, and even social relationships is well established as detrimental to consumer health outcomes (Perlow, 1999; Vuckovic, 1999; Lehto, 1998; Yan et al., 2003; Kivimäki et al., 1996; Roxburgh, 2004). The current research identifies the more subtle, yet still consequential, impact of felt scarcity to consumer well-being and self-control. Specifically, scarcity is demonstrated to direct attention to cues supporting, and promote actions that favor, a "prominent" goal. This translates to compromising long term rewards for the sake of smaller immediate gains (e.g., choosing an unhealthy food item, spending impulsively) among vulnerable consumers (those low in weight-watching success and spending control, and high in eating disinhibition and buying impulsivity). I argue that scarcity promotes such detrimental outcomes by facilitating attention to cues that support an eating enjoyment and spending goal, thus making consumers more vulnerable to the pull of associated temptations.

The existence of an insidious link between scarcity and relative goal accessibility in a self-control conflict has important implications for consumer welfare. Feelings of time scarcity are not a rare or isolated phenomenon (Carroll, 2008). Rather, they can influence multiple aspects of consumers' lives and cross multiple domains (DeVoe and Pfeffer, 2011). Similarly, consumers face shopping scenarios every day in which desired items may be low or completely out of stock. That such

pervasive experiences as time and stock scarcity may contribute to self-control failure is far from inconsequential. However, Studies 4 and 5 demonstrate one possible remediation of the effect of scarcity, by disrupting the proposed process through which it operates. Specifically, exposing consumers to environmental cues such as fitness images or calorie information can offset the effects of scarcity among unsuccessful weight watchers.

Several open questions provide a rich avenue for future research. One possibility involves further disentangling these results from an explanation of cognitive load. This would occur if the manipulations of scarcity depleted cognitive resources in some way. Contrary to this explanation, the semantic priming of time scarcity used in Study 2C and Study 3 should not have been more depleting to participants than their control counterparts. Nonetheless, it is possible that the *subjective experience* of scarcity, and one's preoccupation with it, may drain cognitive resources even after the constraint has been removed and participants move on to an unrelated task. Indeed, this is the mechanism through which Mani et al. (2013) argue that poverty reduces cognitive function, and Vohs (2013) identified these same findings as an instance of ego depletion. Mani et al. (2013) contend that because resources are consumed by concern with scarcity, they cannot be utilized to perform on reasoning tasks. Applied to the current findings, scarcity promotes unhealthy choice because unsuccessful weight watchers, fixated on scarcity, lack the cognitive resources to keep a weight control goal active in working memory (Barrett et al., 2004; Hofmann et al., 2007, 2009).

However there exists in these studies little evidence of *actual* depletion among those in the time scarcity condition. To the extent that effort put forth in a subsequent task provides a rough measure of depletion, one possible proxy is the time spent on the task comprising the dependent variable measure. However, in any of the studies in which timing measures were collected, the time spent on this task did not differ between conditions. Study 3 provides another proxy for exerted effort, the number of words that participants wrote in their verbal reports. While a depletion account would predict briefer responses (in the form of smaller word counts) among the time scarce condition, this was not the case. Clearly, timing measures and word counts are but rough proxies of participants' level of depletion and cannot eliminate this possibility. Nonetheless, these measures show that if actual depletion was significantly different between conditions, it was not manifested in these two obvious ways.

Furthermore, Study 6 allowed for another measure of depletion, accuracy during the dot probe task. If anything, there was evidence of *greater* accuracy among participants in the scarce condition, particular among those high in disinhibition (the very individuals whose unhealthy choice would point to a higher cognitive load or depletion). This finding in combination with the fact that disinhibited eaters under scarcity were *faster* (i.e., exhibited *enhanced* performance on the dot probe task for trials with calorie rich stimuli) is more supportive of an explanation that scarcity does not drain attentional resources in the depletion sense, but rather redirects attention to higher priority stimuli. Along these lines, Shah et al. (2012) argue that scarcity does not merely eliminate attentional resources (as would occur under a depletion framework), but rather directs them towards "managing the scarcity at hand". This is

also consistent with research showing that time constraints can increase focus on a focal task (Karau and Kelly, 1992) and that stress (which although not detected in the process measures collected in these studies, may operate through a similar mechanism as scarcity) facilitates attention to task-relevant attributes and away from irrelevant ones (Chajut and Algom, 2003). Eliminating a physical depletion account still however leaves room for the possibility that exposure to scarcity caused participants to *believe* they were relatively depleted of cognitive resources, and to respond appropriately. This would be consistent with burgeoning literature on the subjectivity of such phenomena, and the important moderating role played by consumer beliefs (e.g., Job et al., 2010; Clarkson et al., 2010; Vohs, Baumeister, and Schmeichel, 2012).

Even if an ego depletion account can be ruled out in favor of the claimed process (directing of attention to goal-relevant cues), the question remains as to through what mechanism scarcity shifts attention to cues supporting a prominent goal. One possibility is that scarcity elicits higher arousal which in turn funnels attention toward the more prominent goal. Though not testing a link between scarcity and arousal experimentally, Cialdini (2009) argued that scarcity elicits a "brain-clouding arousal". Zhu and Ratner (2015) take this theorizing a step further, and provide experimental evidence that scarcity increase arousal as measured by an Affect Grid (a 9X9 matrix with established validity in assessing arousal; Russell, Weiss, and Mendelsohn, 1989). In turn, arousal was found to mediate the polarization of preference in a choice set (i.e., greater choice share of the favorite item) in response to scarcity. Arousal has also been shown to polarize evaluative judgments in a variety of

other domains such as advertising appeals (Gorn, Pham, and Sin 2001), impression formation (Mano 1994), bargaining (Brown and Curhan 2013), and the evaluation of risky prospects (Mano 1994).

Arousal is believed to produce a nonspecific state of activation that is integrated into the evaluation of subsequent evaluative targets. In turn, positive targets are viewed more positively and negative targets more negatively (Schachter and Singer 1962; Zillmann, 1971). It is entirely plausible that an arousal mechanism explains activation of the "prominent" goal under scarcity. Further it is in line with the finding that unsuccessful and disinhibited eaters increase preference for the tasty but unhealthy option, while successful weight watchers and those lower in disinhibition (at least directionally, and in some cases significantly) instead increase their preference for the more *healthful* alternative (see a further discussion of this later in the discussion). However an attempt to identify arousal as a possible mechanism via a separate study drawn from an online population (N=80) failed to identify any difference in scarcity condition vs. control on self-reported arousal as measured by an Affect Grid ($p>.30$). It may simply be that a more sensitive measure of arousal that is less vulnerable to problems of self-report (e.g., skin conductance), may be needed to detect a significant difference between conditions.

A second possible mechanism through which scarcity facilitates attention to eating enjoyment cues and subsequent goal activation may be the activation of general reward seeking behavior. If the experience of scarcity is an aversive state, this may activate a general reward system as a form of amelioration (Briers et al., 2006; Van den Bergh et al., 2008; Wadhwa et al., 2008). Scarcity may make vulnerable

individuals more sensitive to reward cues, prompting them to pursue tasty but unhealthy foods and to spend impulsively. However the "aversiveness" of the scarcity manipulation was not supported by process measures (measures of frustration, stress, or being upset), and unlike a chronic condition of scarcity such as poverty, the scarcity constraint was lifted prior to the dependent variable tasks. Further, such a mechanism cannot explain the reversal in the scarcity effect observed among successful individuals in some studies. Further research is needed to examine this possibility, such as examining whether consuming a reward in a given domain can offset the effect of scarcity in another (e.g., whether consuming a chocolate bar after a time scarcity manipulation mitigates impulsive spending among low self-control males).

Another question for future research is whether scarcity might be adaptive for self-control among "successful" individuals. Across the majority of studies, not only were successful individuals (i.e., those high in weight-watching success, or low in buying impulsivity) spared from a scarcity effect, but a consistent pattern emerged in which scarcity promoted a *reduced* preference for the unhealthy option (Studies 4 and 5) and lower WTP in a superfluous spending task (Study 7). As this pattern did not achieve significance in all studies, caution should be used when drawing inferences here. However this finding is consistent with a goal shielding or counteractive self-control account (Danner et al., 2011; Fishbach, Friedman, and Kruglanski, 2003). Whereas in a neutral condition the highly successful weight watcher or low impulsive buyer may be less vigilant in their avoidance of unhealthy foods or superfluous purchasing, the experience of time scarcity may trigger the shielding of temptations and redirect attention towards the prominent goal (for these individuals, weight control

and financial responsibility). Alternatively, scarcity may distract successful individuals from processing cues such as a food's hedonic properties as has been shown to occur during a concurrent distracting task (Van Dillen et al., 2013). Future research should explore the intriguing question of when and for whom scarcity may promote self-control. As a final avenue of future research, further studies could examine forms of concurrent goal activation that do not involve competing goals, or situations in which there is not a "prominent" goal to which attention can be directed. Under such circumstances it is entirely possible that scarcity promotes a scattering, rather than a focusing of attention, such that neither goal is highly active.

At a time when technological advances allow consumers to do more with their time, this ability to pack more into 24 hours has paradoxically created a nation of "clock watchers" viewing time as the ultimate scarcity (Bell, 1976; Godbey, 1998). Many apparel companies focus their business model on a scarcity principle, with fast style turnovers that require consumers to act immediately or risk items selling out. The present research suggests that such ubiquitous experiences of scarcity in consumers' everyday lives may produce an insidious consequence of self-control failure. Furthermore, this effect occurs primarily among those who are most vulnerable to struggles with watching their weight and impulse buying. However, at least one source of scarcity examined in the present research – time – has been proven to be malleable in perception and can be extended for the benefit of consumer welfare. While little can be done to increase the number of hours in a day, researchers have demonstrated that we *can* increase the subjective experience of time through exposing ourselves to awe inspiring experiences (Rudd et al., 2012), or giving our time away to help others

(Mogilner et al., 2012). The present research provides an additional incentive for consumers to expand their subjective sense of time and to "slow down," so that behavior can achieve alignment with their valued goals.

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